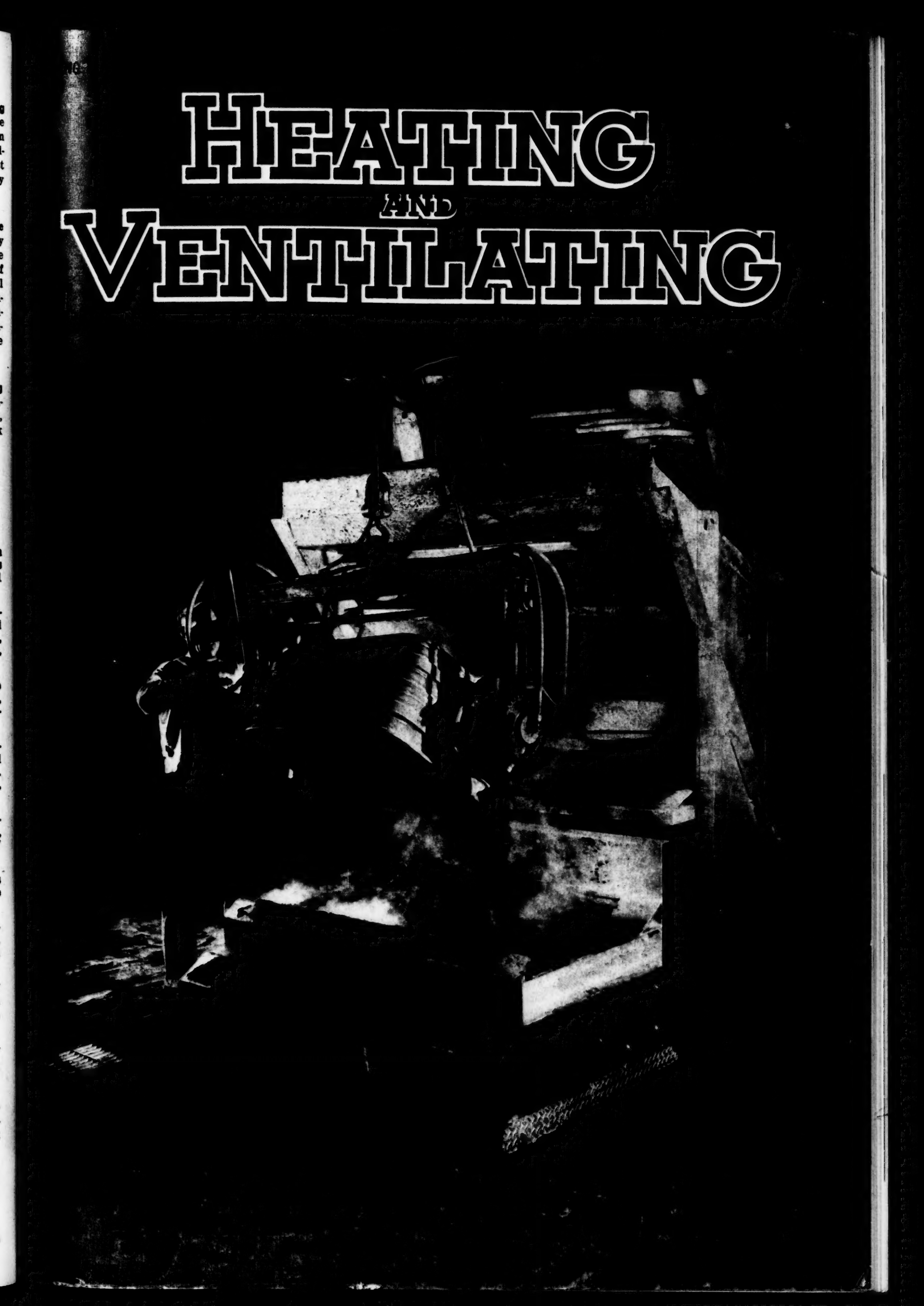
HEATING AND VENTILATING



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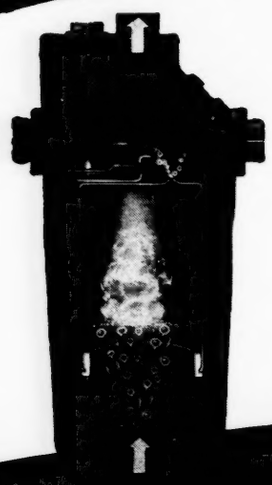

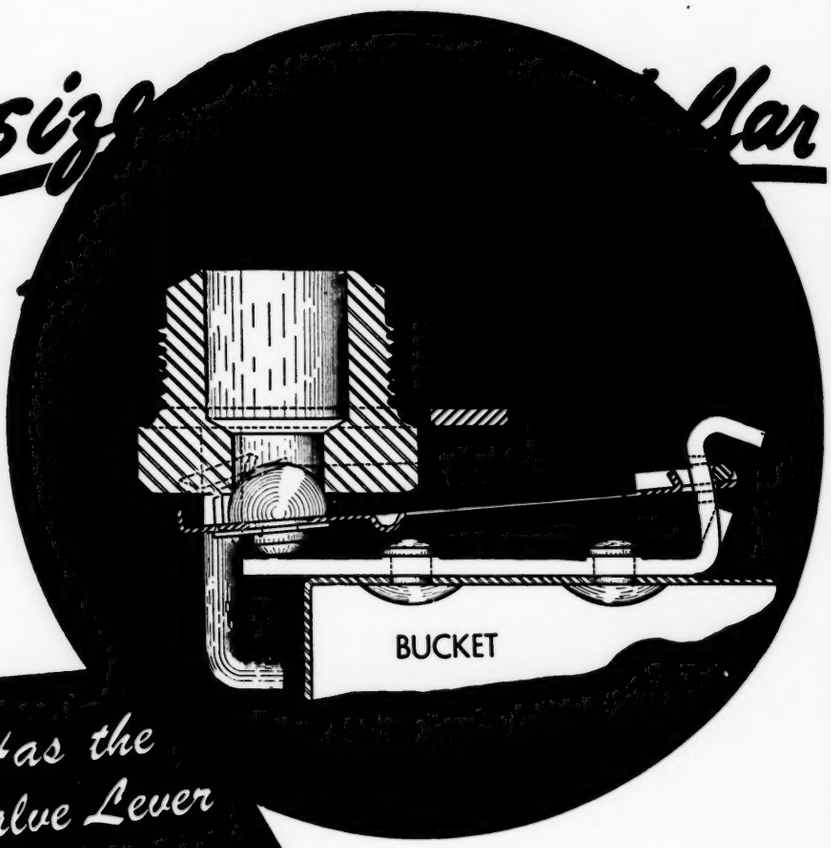

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HEATING AND VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH THE DESIGN AND APPLICATION OF AIR CONDITIONING, REFRIGERATION, PIPING, AIR SANITATION, HEATING AND VENTILATION IN BUILDINGS

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THIS MONTH'S COVER

One of the large ventilated shake-outs in the Westinghouse Electric Corp., East Springfield, Mass., foundry. Such provisions for handling dust and excess sand have resulted in an exceptionally clean foundry with a particularly low dust count.

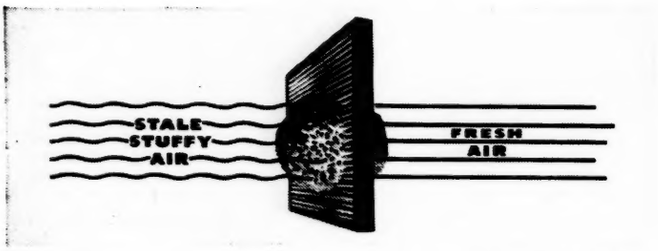
Three air conditioning problems that Air Recovery can solve

1. When the heating and cooling equipment cannot handle enough ventilating air to supply the fresh air demand.

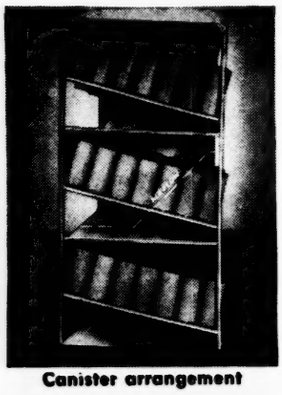
2. When adequate ventilation requires bringing in large volumes of out door air *which has to be conditioned at considerable cost.*

3. When it's difficult to bring in outdoor air or when the intake air isn't sufficiently *odor-free* for adequate ventilation.

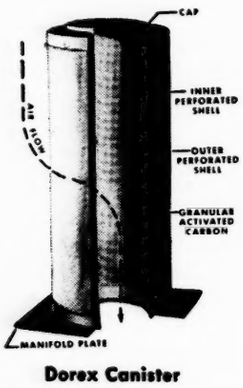
Actual installations show solutions—demonstrate how Air Recovery cuts costs



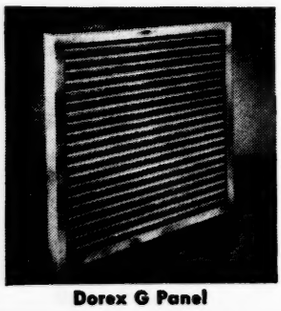
It works like a sponge. The air circulates through beds of specially processed Dorex activated carbon, which literally soak up the most minute traces of any odors originating from occupants and their activities, foods, beverages, tobacco smoke, machines and kindred sources. Thus, recirculated air, already heated or cooled, is restored to original freshness, making it acceptable for human consumption or industrial processes. Average resistance to air flow added by Dorex Units is about 0.15" water gauge, a negligible percentage of a system.



Canister arrangement



Dorex Canister



Dorex G Panel

Dorex types and sizes have been developed to fit all standard air conditioning installations. G panels are used where space is limited and in unit air conditioners. Canisters are installed in the duct of central station type of air conditioning systems.

IN THIS MAGAZINE in Oct. '48, we described how the majority of railroad companies solved the first condition mentioned above. In Dec., we reported how the second condition was overcome in the Criminal Courts Building, New York. In the present case, the engineers improving the air conditioning for the First National Bank Building, Detroit, were faced not only with the third condition, an intake air odor problem, but with the first as well—the cooling equipment could not handle enough ventilating air to supply fresh air demand.

The solutions to these problems illustrate where, how, and why you can profitably design Dorex Air Recovery Equipment into similar high occupancy jobs.

Even though the outdoor air intake of the First National Bank Building is located at what is ordinarily a good position on the fourth floor level, it was befouled under certain wind conditions by kitchen exhausts from several neighboring restaurants. In addition, business in the bank had increased. Added personnel and customers created a ventilation demand that overtaxed the existing conditioning equipment to a point where the operators had to choose between desirable temperature and proper ventilation. At times, it was necessary to bring in a maximum amount of air for dilution purposes. You can imagine the spot they were in when cabbage smells were coming their way.

The application of Dorex in a case like this is simple. Since it is a problem of ventilation—and that's a problem of odors—remove the odors. That's just what the engineers did.

They installed enough activated carbon canisters to purify 20,000 CFM of return air and 10,000 CFM of outdoor air. The 30,000 CFM of fresh air provided ample ventilation. (See before and after installation sketches.)

Since the existing conditioning equipment could handle the 10,000 CFM of outdoor air easily, this solution not only eliminated the need for additional conditioning equipment, but saved on operating expenses as well. In February, before the first heating season with the Dorex equipment was over, Merle Bennett, the Chief Engineer of the First National Bank, reported that he had already saved 108 tons of coal and

Washington News

LORING F. OVERMAN

AS February dawned with Washington still digesting the President's four January messages—Inaugural, State-of-the-Union, Economic Report, and Budget—it became apparent that Americans may as well get used to an entirely new concept of the role Government expects to play in tomorrow's affairs, both domestic and global.

Based on the President's campaign promises, it was a foregone conclusion that domestic problems would involve a new high in paternalism. Few were prepared, however, for the global program hinted at in the Inaugural address. The full meaning of these hints has not yet been fully realized, and may not be in this generation. There is plenty of room for speculation, however, in the President's hint of a world-aid program—to combat Communism—which will include arming of friendly nations, plus a program which is to develop the natural resources of those countries through American financing and know-how.

To answer the initial protest, "Can America afford such a program?" Administration proponents counter, "Can we afford not to?"

Right there the impasse is reached, for it is becoming increasingly obvious that this country is not to be permitted to go about her own business, solving her own economic problems on her home grounds, as long as another country openly regards the entire world as its particular oyster. And there seems to be no secret about the plans of Communists to extend their influence as far and as rapidly as they are permitted to do so.

President Truman's inaugural tipoff that the threat is recognized and will be combated by means with which Americans are most familiar—through helping other nations to produce and raise standards of living above the empty promises of Communism—doubtless sets the pace for the future. To those who insist that such a program is beyond our financial means, some may point out that World War II cost some $200 billion dollars of American money, plus many thousands of American lives—yet settled nothing. No one questioned whether we could afford that effort and sacrifice. The obligation was merely accepted as inescapable. Doubtless the same reasoning will be applied to this new demand for sacrifice—as an alternative to war.

If this country were less concerned with the rights and lives of individuals, it might be concluded that a shooting war at this time would be more effective than a cold war. But the American conscience would not rest easy unless every other alternative, no matter how expensive, were tried first. Oddly enough, those responsible for the cold war, including the blockade of Berlin, appear convinced that our present plan of sending dollars out to fight for us will defeat us in the end. They are convinced that our hated capitalistic system just cannot stand the strain.

Who is right remains to be seen, for the President states frankly in his budget message that expenditures for national defense and other purposes will be greater in 1951 than in 1950. He says that "expenditures for national defense can be expected to rise substantially above the level for 1950, and that we cannot expect any material decline in our international responsibilities," and that as to the overall total, "even higher expenditures will probably be required in future years."

Seen in the President's Inaugural hint is the possibility that American planners may envision this country as taking over the role formerly occupied by Great Britain—going into backward countries with money, machinery, and brains, to develop resources and raise living standards. The President has suggested that both private enterprise and government must join resources in this great new venture. It remains for members of the heating, ventilating and air conditioning industries to determine just what such a world-aid program will mean to them.

One Certain Thing – Taxes

The one thing of which all may be certain is that new taxes will be required. In his Budget message the President asked for a mere $4 billion—barely enough to cover projected domestic innovations covered by campaign promises, without even considering the global program. Current Congressional thinking is to adopt a wait and see attitude, and to step up taxes only after being convinced of their absolute necessity. Many of the members of the current Congress had a part in reducing taxes at Republican insistence, and few of the new Democratic members want to have it said that the raising of tax rates was one of their first official acts.

It is considered likely that the House Ways and Means Committee—where tax measures originate—will move somewhat slowly. First it will want to see just how far the 81st Congress goes in launching new domestic projects, and then it will want to keep an eye on revenue trends. The President has estimated a deficit of half a billion dollars for the current fiscal year, but members of the committee haven't forgotten that he estimated the shortage would be $1.5 billion, only a few months ago.

Congress Under Way

Meanwhile, with inauguration and other festivities over, Congress got down to serious business on matters of immediate concern during the week of January 24. Several committees began hearings on new legislation, and others met for organization sessions. Controversial legislation is being readied for early consideration, with the green light given several expiring laws.

Hearings on a bill to extend Reciprocal Trade Agreements for three years from last June started January 24 before the House Ways and Means Committee, with early and favorable action forecast. Another bill ex-

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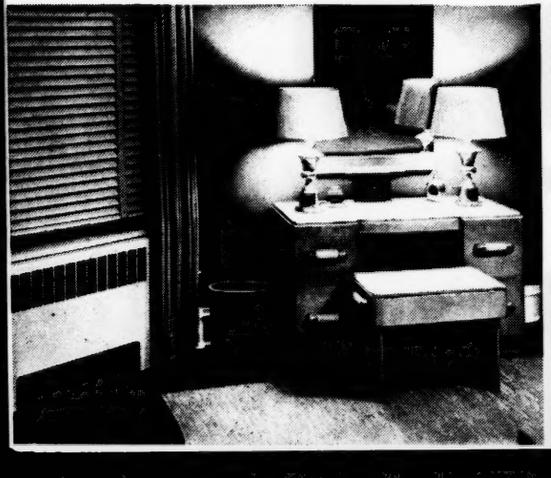
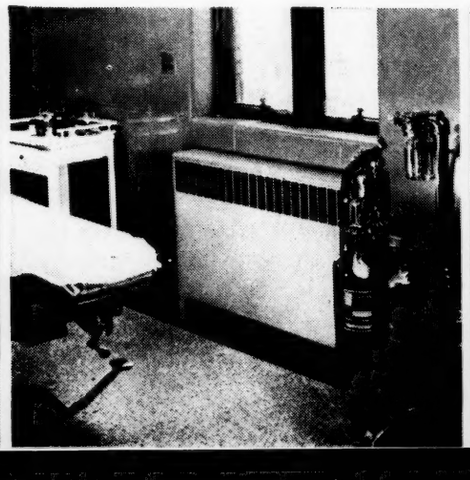
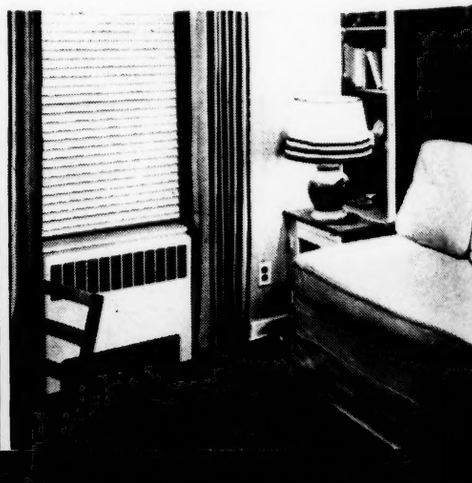
Trane Convector-radiators really *fit*—in home, office, shop or institution







pected to pass quickly is one broadening conditions under which displaced persons may enter the United States. A third measure expected to encounter little opposition is one to establish a National Science Foundation to develop and encourage a national policy for scientific research and education.

Requiring earliest action are bills to extend export controls, expiring February 28; voluntary allocations, expiring March 1, and rent controls, expiring March 31. Favorable action on all three is anticipated, despite expected opposition to the rent control measure.

Voluntary Allocations

Confident that voluntary steel allocation authority will be continued, the Department of Commerce announced, in mid-January, two new plans—one covering mining machinery and the other special ore-carrying cars. The new plans provide the following amounts of steel monthly: 26,400 tons for the production of mining machinery and repair parts, and 2,576 tons to the Canadian Car and Foundry Co., Ltd., for the manufacture of ore cars to be used by the Union of South African Railways for transporting manganese-bearing ore from South African mines to tidewater. The latter program is expected to result in additional shipments of manganese ore for the U. S. Government strategic materials stockpile.

(Incidentally, expect to find the name of South Africa appearing more frequently as the new global-aid program takes form. That name is on the list of those offering great opportunities for such a program as Administration planners have in mind.)

Eight other voluntary plans now in effect—some of them of indirect interest to H&V readers — were approved for continuance through August, Congress willing. They provide the following amounts of steel monthly: (1) 102,505 tons for requirements of the Armed Forces; (2) 16,414 tons for requirements of the U. S. Atomic Energy Commission; (3) 1,926 tons for the National Advisory Committee for Aeronautics; (4) 16,530 tons for the manufacture of oil field tank and production equipment; (5) 40,380 tons for construction and repair of oil tankers; (6) 15,415 tons for construction and repair of merchant vessels; (7) approximately 250,000 tons for construction of new domestic freight cars and repair of railroad rolling stock, and (8) 25,000 tons for construction, conversion and repair of freight-carrying barges.

Three other programs presently in effect have not been approved for continuation beyond February 28. They provide monthly allocations of (1) 2,570 tons of steel for maintenance and repair of anthracite mines and preparation facilities; (2) 31,625 tons for production of warm air heating equipment, and (3) 9,835 tons for production of all-steel manufactured houses. Another program, providing 102,810 tons of pig iron monthly for the production of cast iron housing items, has not yet been approved for continuation beyond February 28.

New Housing Bill

Already in the Congressional hopper, but not scheduled for early action, is a new housing bill introduced by Senator Ellender (D.-La.), proposing the construction of 1,050,000 publicly financed units over a seven-year period. This is about twice the number contemplated in the Taft-Ellender-Wagner bill. Current estimates are that all features of the new bill, which actuates the Administration program, will eventually cost more than $17 billion.

Title I of the new bill would provide federal loans and capital grants to local communities for the clearance of their slums and blighted areas. Funds available under this title would permit acquisition and preparation of land.

Title II amends the U. S. Housing Act of 1937 to increase from $800 million to $1.5 billion the borrowing authority of the Public Housing Administration for purposes of "an extension of the low-rent public housing program to serve urban and rural non-farm families whose incomes are so low that they are not being adequately housed in new or existing private housing." Veterans and veteran survivors would be given preference in the five years after March 1, 1949. Income limits are fixed for continued occupancy and allowances are made for larger families. Cost limitations by size of community would be eliminated. Limitations on dwelling cost units would also be eliminated, and cost limitations per room would be raised to $1,750.

Annual contributions by the Public Housing Administration are authorized beginning at $85,000,000 in the year following July 1, 1949, and rising to $445,000,000 per year in the fifth year. This authorization would permit construction of up to 1,050,000 dwelling units.

Title III amends Public Law 901 and amplifies the powers of the Housing and Home Finance Administration in the field of housing research.

Title IV authorizes the Secretary of Agriculture to provide financial assistance in erecting dwellings on farms.

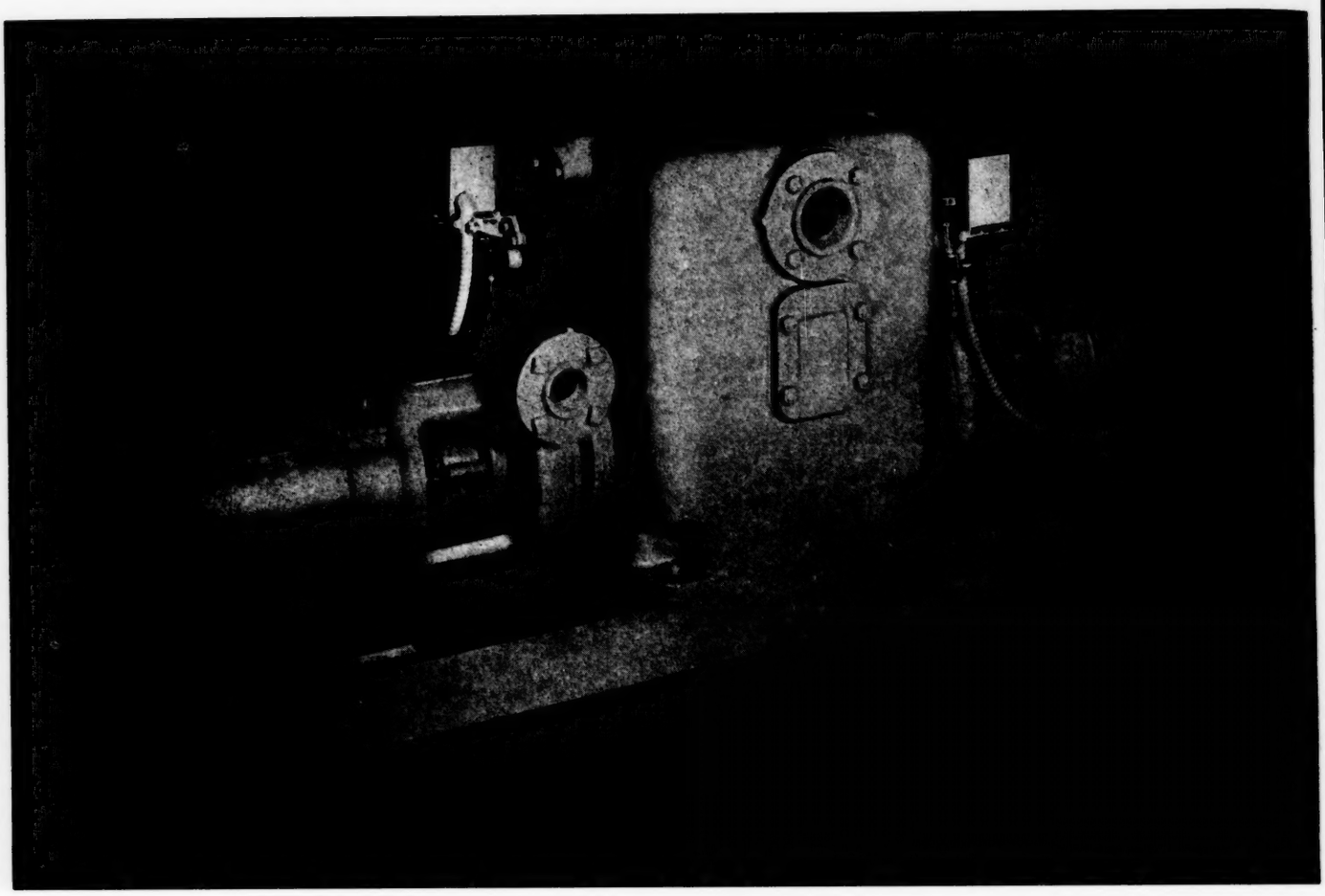
Title V provides that the Secretary of Labor or his designee shall be included in the membership of the National Housing Council, authorizes the Housing and Home Finance Administrator to appoint advisory committees, and amends certain provisions of the National Banking Act, the Government Corporation Appropriation Acts of 1948 and 1949, and the Internal Revenue Code.

The bill, it should be understood, has reached only the "introduction" stage. Hearings before Senate and House Committees, then submission to both Houses of Congress, must precede final passage. Senator Taft, who joined Senator Ellender in sponsoring the bill passed by the 80th Congress, is not one of the sponsors of the new bill. It is understood that Republican senators are drafting another version.

Military Purchasing Index

The Munitions Board has issued a new, condensed "Index of Military Purchasing Offices" for the Army, Navy and Air Force. Copies may be obtained by writing to F. B. Brinkley, Munitions Board, Washington 25, D. C.

MAXIMUM EFFICIENCY FOR STEAM HEATING SYSTEMS ON HEATING, DRYING AND PROCESS WORK.



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Designed for steam systems on heating, drying, or process work, these pumps offer the most reliable and efficient means of returning hot condensate to boiler or hot well. In many cases these pumps will save costly installation of boilers in a pit to provide gravity flow of returns from basement radiators and heating devices.

The Jennings Condensation Pumps are sturdy and compact in construction, and combine receiving tank, pump and driving motor in a single assembly. Pumps are bronze fitted throughout, with tobin bronze shaft. The pumping impeller is of special design, made possible by our wide experience with return line heating pumps, and is especially adapted for handling hot water with the greatest possible efficiency.

Full automatic control is furnished by means of a ball float and float switch mechanism mounted on the receiving tank. All wiring is made up at the factory, and it is necessary only to connect the pump to the system and hook up the leads. Complete information regarding these economical pumps sent promptly on request.

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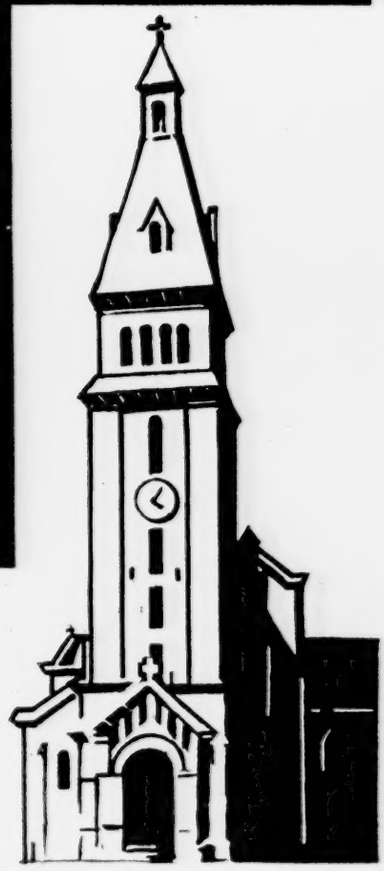
HEATING AND VENTILATING

Problems in Air Conditioning Church Buildings



M. FRANK WOOTEN, Jr.
Consulting Engineer, Charlotte, N. C., and
C. N. WITMER
Ross & Witmer, Inc., Air Conditioning Contractors, Charlotte, N. C.

Churches require special air conditioning design considerations because of the sudden cooling load involved and the infrequent building occupancy. Several types of systems are described as well as problems inherent to the cooling of churches.

WITHIN the next ten years, most churches will enjoy air conditioning. As simple as that statement is, it fails to carry with it an implication of the many problems one must solve before air conditioning systems in churches can function properly and adequately. These problems are not simple.

For example, until recent years, theater air conditioning was considered one of the most difficult air conditioning applications. This was caused by conditions established by the patrons.

(1) They want a sensation of comfort as they enter the door.
(2) The patrons are seated and at rest in the theater for about two hours. During this time they become thoroughly acclimated to theater conditions.
(3) They expect to be comfortable even at the end of the performance and object very strenuously to drafts or over-cooled sections.

These conditions within themselves present many problems to the air conditioning engineer. Most of these problems, plus a few more, exist in church air conditioning. As a rule, the churches have a zero or near zero person load until a few minutes before the church service begins, then the full person load is placed on the equipment within probably a ten- or fifteen-minute period. This sudden application of the load gives the air conditioning engineer another serious problem.

Churches are frequented by persons of all ages and almost every state of health. The conditions which would create a sensation of comfort to the sixteen- and eighteen-year-olds will be far from comfortable to more elderly persons within the auditorium.

Storage System

To obtain satisfactory air conditioning of churches we have used three types of systems. With one type we used a large storage tank about 20 ft long, 8 ft wide and 6 ft deep to store cold water during the week. A 7.5 hp compressor running approximately 80% of the time was used to cool the water in this tank during the week so that by Sunday this water was cold enough to circulate through the cooling coils in this church seating 1,000 persons.

The first cost of a job of this design is somewhat less than a system using the conventional direct expansion system; the operating cost is also less because of the smaller compressor that is required. The demand charge represents another advantage although in many cities the power companies do not demand a charge for connected horsepower of churches. The disadvantage is that there is not sufficient refrigeration capacity for more rapid cooling should it be necessary to use the church during the week.

System a Part of Heating Plant

Another system was for a small church seating 500 persons. Here we tied in the air cooling system with the heating system. This church has a warm air heat-

View from the rostrum of the First Baptist Church, Charlotte, N. C., to show the air supply outlets under the balcony.

ing plant with two warm air outlets at the front of the church. We installed a cooling coil in the discharge air duct and connected it to a 15-ton water-cooled compressor. Were it not for the fact that water pressure in this municipality was low, we would have been able to use city water. However, the water pressure was so low that we could not satisfy our cooling needs and we had to resort to a forced draft cooling tower.

Although this provided a crude air conditioning system for the church, it functioned satisfactorily. From the design standpoint we do not like to blow cold air from the the front of the church directly towards the people, but prefer to discharge the cool air from a point high in the back of the church and to have the air streamline across the ceiling to slowly filter down through the auditorium. Because of existing building conditions, it was impossible to place air conditioning ducts in the rear.

Church at Charlotte, N. C.

The third type system, which will be covered in more detail, was installed in the First Baptist Church, in the downtown section of Charlotte, N. C. This church, consisting of 1,300 seats with a main floor and balconies on both sides and at the rear of the building also has a choir loft, entrance vestibules and high ceiling. Being typical of a downtown church with traffic noises and dust a major factor, this building was selected to illustrate some of the problems involved in the air conditioning of churches.

The history of the First Baptist Church shows a note of the conservative tempered with the progressive. No other church in the area had installed air conditioning so the Board of Deacons could not profit by the experience of others. The board favored installing a year-'round air conditioning system along with other repairs.

Engineering studies were begun and the following major considerations entered the picture:

A large, high dome forms a large part of the ceiling over the main auditorium. It was first thought that air might be distributed from the upper area. However, the difficulties of installing either the air handling equipment or a duct system, plus the fact that the stratified upper air could be used as insulation, ruled out this consideration. Therefore, in the final cooling load calculations, the dome was practically neglected. This meant that smaller equipment could be considered by leaving the upper air undisturbed.

Entrance vestibules were struck from cooling considerations, since the large outer doors were kept in the open or near-open position for about a quarter of an hour, just before the services, by persons entering. This large vestibule acts to temper the load conditions during the cooling season and is heated by direct radiation during the heating season.

Many calculations and much thought were required to select the type of system best suited for this design. At first a storage system was considered whereby a small compressor or compressors would chill stored water during the week for use during the services. This was eventually ruled out.

Uses of the auditorium called for two services on Sunday, a regular mid-week service and, due to the large membership and the fact that the church is located in the heart of the downtown area, many special assemblies for weddings, funerals and other gatherings. The size of the necessary storage tanks was a major item. Since such space was not available above ground, and excavation for the tanks under the building would be costly, a storage-type system could not be considered.

Other types of systems were studied, but the final decision was made in favor of direct expansion, with two units of about 40-ton capacity each installed and set for two-step operation, with one unit to come on or cut out a few degrees higher or lower temperature than the other.

Next, the question of waste water, cooling tower, evaporative condenser and well, had to be settled. We had to examine the probable number of hours per season that the system would operate as against the cost of waste water; possible future water company rulings against waste water; cost and location of cooling tower; cost and location of evaporative condenser; cost of a well and the sanitary rules governing its use; drilling a dry hole; and the location of the well. Each factor had to be studied.

In the case of this church, it was decided to use two evaporative condensers located at the open end of a very narrow light and air space between the church and the adjoining business building, but facing an open public alley for an assured supply of fresh air. This equipment, of course, had to be protected from public abuse with a heavy wire enclosure.

It would have been a waste of funds to use evaporative condensers if the city water pressure was sufficient to supply the necessary amount of water at the required pressure. For this installation, the cost of the evaporative condensers increased by 15% the cost of the entire system. The amount of water that can

be used on a waste water system is getting to be such an important factor in most cities, that we were afraid to take a chance here. For the other side of the picture, one must remember that the big church load comes on Sunday when water demand is rather low in most cities.

Air Distribution

The method for handling air distribution finally adopted was to treat the entire area in three parts and to handle each separately. The balcony extends across the rear and about one-third of the way to the front. On each side there are narrow balconies, which were being added during the air conditioning installation.

That part on the main floor, which was not under the balconies, was treated as one part and was supplied with air from the front edge of the rear balcony. That part under the rear and side balconies was considered as a second part and supplied with air through sidewall-type grilles, sized and located to cover these areas. All balcony areas were supplied from the main rear wall with grilles located and spaced to blanket the area and still avoid spillage over the edge of the balcony where it would not be picked up by the air streams from the edge of the rear balcony.

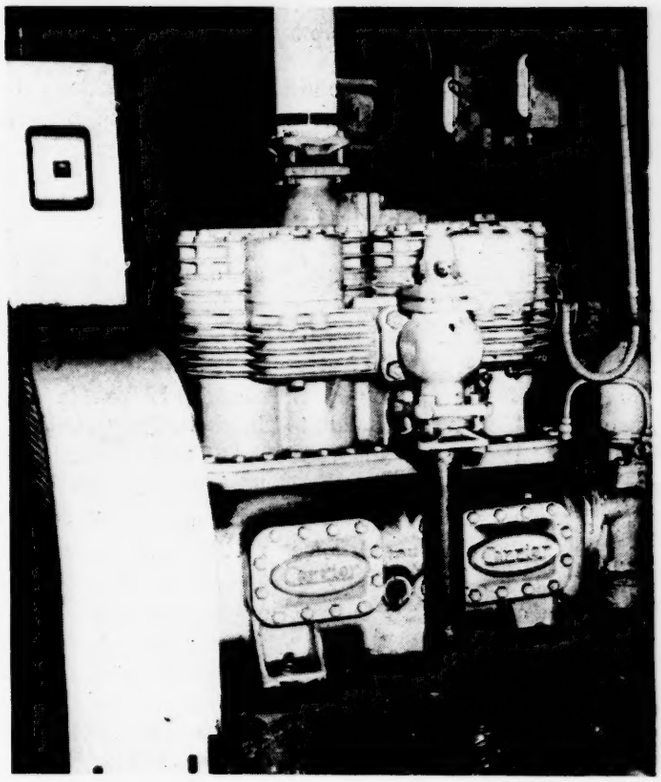
The possibilities of air noises through the grilles and in the duct system required considerable attention, since the noise level had to be very low. This also held for the selection of the air handling unit. Fan tip speeds and outlet velocities were studied in their relationship to noise production. In addition to these studies and precautions, parts of the duct system were acoustically treated on the inside to reduce the possibility of noise being transmitted through them.

Return air was taken through four large return air grilles located above the baseboards on the two sidewalls. These return air grilles were sized large enough to remove all chances of air noise through them and were located about three feet from the nearest seats. Fresh air was taken in through only one of the two air handling units, since both units were expected to be operated at all times for circulation reasons.

Placement of Equipment

With space at a premium, a suitable location for the equipment was a problem. A partly excavated area under the large front vestibule was selected for an equipment room. This was near enough to the main air duct risers at the rear of the auditorium and yet far enough removed from the auditorium for sound isolation. Objections to locating the equipment room under the vestibule were that the space was remote from the steam boilers, water and drain lines and all excavation had to be done by hand.

All machines were set on heavy concrete pads and isolated from the building. Flexible connections or horizontal loops were used to connect all duct work, piping and conduits. In addition, the space itself was acoustically treated and sound-proofed to reduce noise.



Forty-ton compressor, part of the air conditioning system installed in the First Baptist Church, Charlotte, N. C.

Natural ventilation for the equipment and room was obtained by installing louvers in place of the window openings already installed.

Where plans are being considered for new church buildings, attention should certainly be given to the placement of ducts for air conditioning systems. In Charlotte, there are several churches that are eight to ten years old so that it will be necessary to tear into the church at certain spots to install ducts for air conditioning. The comparatively small cost for duct work that would be added to the entire building cost, if installed at the time that the building is erected, would represent a considerable saving in the future installation of an air conditioning system. Because of the trend towards air cooling of churches, such a step is an indication of good planning and building design.

Controls

Control of the system was by means of remote bulb thermostats, located in the return air ducts to operate face and by-pass dampers or steam valves in the air handling units. Fan operation was constant during the cooling season, but a limit control was provided to shut off the fans during the heating season if the circulated air was below the predetermined temperature setting. Steam to the heating coils was controlled by modulating motorized valves in the supply lines. To assist in a quick heat pick-up in the auditorium, and to avoid maintaining heat in that space when in use, several of the old radiators were left in place. However, they are rarely used and only during extreme outside temperatures. All radiators are shut off during normal operation.

Operating Costs and Economy

The economy of air conditioning installations in churches is a much discussed item since, as a rule, the system is used such a small percentage of the total available time. Every church must be run on a business basis and its financial dealing must be kept sound.

Although the primary purpose of any church is religion and other things pertaining to it, the principal means of achieving this is through attendance at the church services. If attendance can be improved, the work of the church is improved. If people are uncomfortable, it is hard to hold their attention. Therefore, it is generally conceded that the resulting costs are justified. Experience has also shown that church air conditioning is a good business investment as the increased attendance results in increased offerings.

Very careful check was made of the operating costs in this church for the past three years. Because the electrical wiring was changed, the church enjoyed a lower power rate. Power costs for operating the system was only about $120 a year more than the year before air conditioning was installed. Spread over a 12-month basis, this results in a monthly charge of $10.

As for the actual maintenance, the amount of refrigerant required each year is estimated at $180 so that the total yearly operating cost is established at about $300.

The day is not too far off when most churches will be air conditioned. While the problems involved, from an engineering viewpoint, are many and vary with each installation, they can be solved by the application of good, sound engineering principles. The biggest problem of all is the selling the idea that air conditioning of churches is not only good from a business viewpoint, but that it is one of the best spiritual investments.

Problems in Heating and Ventilating Garage for Buses

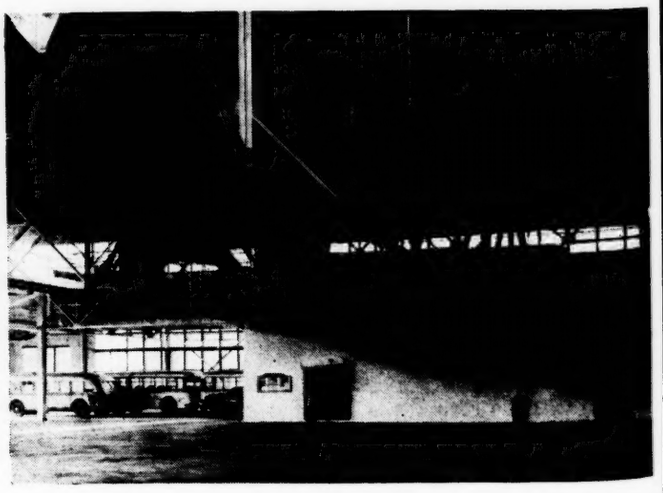
Removing troublesome motor exhaust fumes from a large bus maintenance garage and, at the same time, providing comfortable working conditions during cold weather, were problems that confronted the engineers who designed the headquarters of Ohio Bus Line Company at Hamilton, Ohio.

Three high velocity, oil-fired warm air heating units, arranged to operate both with fresh air drawn from the outside and recirculated air from within the structure, were provided to maintain comfortable temperatures for the main area. Two of the direct-fired Dravo units have a capacity of 2,000 Btu each; one 1,500,000 Btu. Two exhaust fans connected to an under-the-floor duct system remove 80,000 cfm of air from the building. They serve a building, 250 ft long by 200 ft wide, with the front wall, in effect, made up of seven large doorways. Five of the doorways are 30 ft wide each.

When the garage is crowded with buses warming up for morning runs, the heaters draw fresh air from the outside through louvered openings in the heater room wall. This is discharged into a network of overhead ducts in the garage area. In winter, the outside air is quickly warmed in each heater, passing over a stainless steel combustion chamber in which the oil is being burned. When bus exhaust fumes are not prevalent enough to cause discomfort in the garage, the heaters are operated on partial recirculation of air already within the structure. This conserves fuel. To operate the system on recirculated air, the louvered outside wall openings in the heater room are closed and air from within the garage is drawn into the room for reheating through a return duct located about 10 ft above the floor.

The overhead warm air supply ducts are arranged to blanket the entire garage for uniform and effective distribution of heat. Despite frequent opening of the large doors, a temperature of 60F can be maintained almost continuously.

From a functional standpoint, the new garage is one of the most modern of its kind in the country. The floor plan is arranged for quick servicing of motor coaches. Full maintenance, including repainting of buses can be carried on under the same roof. One side is designed for servicing on a production line basis. Buses are driven on either side of a gasoline pump island for fueling. An electric bus washer is the next operation on the production "line," beyond which are three hoists. Buses can be driven from the rear of the building after servicing, to avoid congestion.



Warm air is discharged from overhead ducts to keep garage at proper temperature. Three direct-fired warm air heating units are used.

The Effect of Comfort Requirements on Panel Design

WILLIAM P. CHAPMAN
Product Engineering Department, National Tube Company*

When actual performance of radiant heating installations disagrees with calculated performance, the error obviously is in the calculations. Mr. Chapman shows that selection of constants involving comfort requirements of the heated space has an important bearing on the accuracy of design calculations.

OF the thousands of radiant heating installations that have been operating successfully, some are apparently defying a satisfactory explanation. Calculations seem to indicate the systems are inadequate, yet there are no complaints from the occupants. On the other hand there are some cases where the radiant systems are actually inadequate and calculations indicate that the equipment is of the proper size.

There are two cases that seem especially bewildering: (1) A garage radiant system was installed without any design at all—pipes were laid in the entire floor, but nowhere else. The *next spring after a successful winter* an engineering calculation showed the system had 63% of the calculated panel area. (2) A room intended as a sitting room for an elderly lady was considered sufficiently "over-designed" to provide added warmth, but in mid-winter observations showed that there was insufficient panel area.

It will be shown that the fault of the engineering calculations was in failure to select the proper comfort coefficient. If the designer, or investigator, had selected the proper comfort requirement for the design conditions and had then proceeded with the calculations for panel area and output, there would not be a discrepancy between the calculated and actual performance.

The comfort coefficient, as it is used in this discussion, is the sum of the inside air temperature and mean radiant temperature required to satisfy the comfort requirements of the occupants. Stated in equation form it is:

$$a = t_a + MRT$$

where a is the comfort coefficient, or comfort constant, t_a is the inside air temperature, and MRT is the mean radiant temperature. This equation has appeared in the literature (1,2)[1] and is based upon actual investigations. Table 2 shows several values of a.

From the definition of a, it can be seen that merely changing the inside air temperature will *not* be sufficient allowance for adjusting the comfort requirements from home or office standards to garage or sitting room standards. For example, the usual allowance in computing panel area for a garage is to assume an inside temperature of 60F (instead of the 70F for a home), and then proceed as in designing for a home or office.

The proper procedure, from the definition of a, is to change the inside temperature t_a, and the MRT. The MRT, however, includes the panel area and temperature and the non-panel areas and surface temperatures. In other words, the unknowns must be known before making the calculations. This seeming paradox can be avoided by using the cubic equation for panel areas which has been derived in the literature (2):

$v^3 W + v^2 X + vY + Z = 0$. (See glossary of terms.)

It will be noted that a appears in the G, J, and K parameters involved in coefficients X, Y, and Z, but that t_a does not appear; therefore t_a need not be known at first. By substituting the desired a in the cubic equation terms, the effect of comfort requirements on panel design may be determined.

A general explanation of the effect of a on panel area and output is that the convection and radiation rates from the panel are altered when a is altered. When a is reduced either t_a or MRT or both are reduced. As t_a is reduced the convection rate from the panel is increased, and as the non-panel temperature is decreased the radiation rate is increased. In gen-

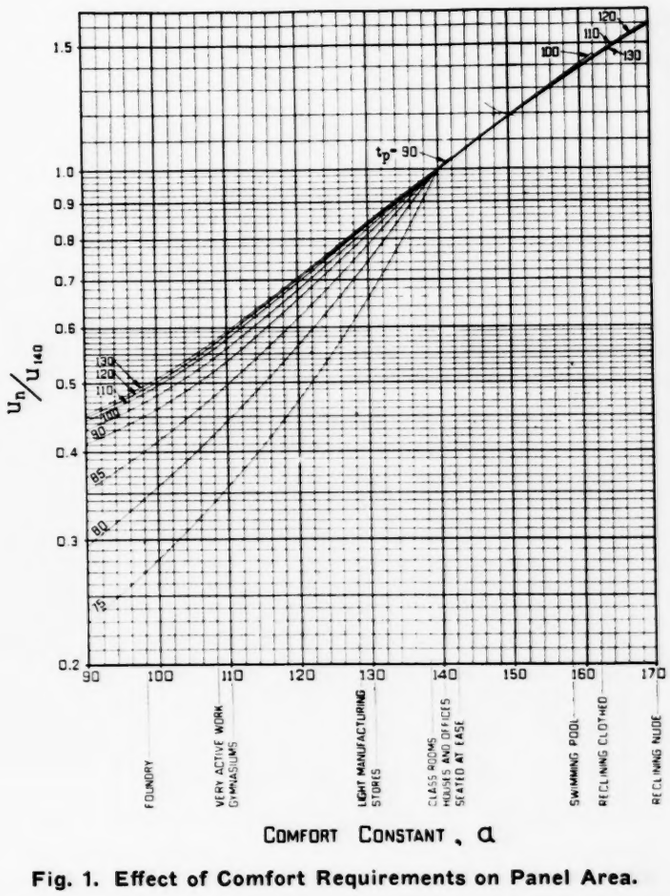


Fig. 1. Effect of Comfort Requirements on Panel Area.

*U. S. Steel Corp. Subsidiary.

[1]Figures in parentheses refer to references at the end of the article.

Table 1 — Summary of Results of Calculated and Graphical Solutions

Panel Location[1]	Conditions					Actual Design			Approximated Design			% Error		
	t_o	t_p	a	U_e	V_e	u	t_a	q_t	u	t_a	q_t	u[2]	t_a	q_t
F	+ 20	80	98	0.08	5	0.117	48.1	71.6	0.099	48.5	68.5	2.0	0.8	4.3
F	+ 10	85	120	0.20	1	0.168	60.2	58.8	0.156	60.7	61.0	1.4	0.8	3.7
F	+ 10	85	120	0.08	3	0.110	58.9	57.0	0.122	59.4	57.1	1.3	0.8	0.2
W	+ 10	100	160	0.20	1	0.277	79.1	42.1	0.264	78.9	41.1	1.8	0.3	2.4
C	+ 10	90	110	0.04	5	0.102	51.7	52.9	0.122	51.9	53.0	2.2	0.4	0.2
C	0	90	100	0.04	5	0.099	46.3	60.8	0.118	45.4	60.8	2.1	1.9	0.0
C	0	130	100	0.16	5	0.091	45.5	127.3	0.084	44.6	127.8	0.8	2.0	0.4
F	— 10	85	120	0.20	3	0.259	59.6	63.2	0.226	59.4	64.5	4.4	0.3	2.0
C	— 10	85	120	0.20	3	0.315	55.5	43.3	0.290	55.1	44.5	3.6	0.7	2.8
C	— 20	120	150	0.12	5	0.231	67.0	73.2	0.249	67.1	72.3	2.3	0.1	1.2
										Average		2.2	0.8	1.7

[1]F = floor; W = Wall; C = ceiling.
[2]Error based on Non-panel area.

eral then, as a is decreased, panel area and t_a must be decreased and panel output is increased; as a is increased, panel area and t_a must be increased and specific panel output is decreased.

Engineers rarely have time for an exact, rational solution of any equation as involved and tedious as the above cubic equation; therefore, Fig. 1, 2, and 3 were prepared as *approximations* of the effect of comfort requirements on panel design. These figures are not intended for use without careful consideration of their limitations and derivations as set forth in the Appendix. The graphs are suggested for use where 5% error is acceptable. In such cases Fig. 1 can be used to determine panel area, Fig. 2 to determine inside air temperature, and Fig. 3 to determine panel output. Table 1 gives a summary of 10 examples using Fig. 1, 2, and 3, and actual values as determined by the cubic equation.

Example

Let us assume a structure has been designed for a ceiling panel to operate at 90F surface temperature and 140F comfort constant. For this system, the panel must occupy 25.6% of the *total* surface area of the room[2]. The designer now wants an identical room to maintain a comfort standard for gymnasiums where a = 110F. By entering Fig. 1 at a = 110 and intersecting the t_p = 90 line one reads the ratio of adjusted area to area where a = 140, that is the u_n/u_{140} factor, as 0.534. Thus the required panel area for a=110 is only $0.534 \times 0.256 = 0.137$ or 13.7% of the total surface area. Similarly it is determined from Fig. 2 and 3 that $\frac{t_{an}}{t_{a140}} = 0.775$ and $\frac{q_{tn}}{q_{t140}} = 1.71$,

[2]Calculated from an actual design when V_e = 5, U_e = 0.04 and t_o = 0.

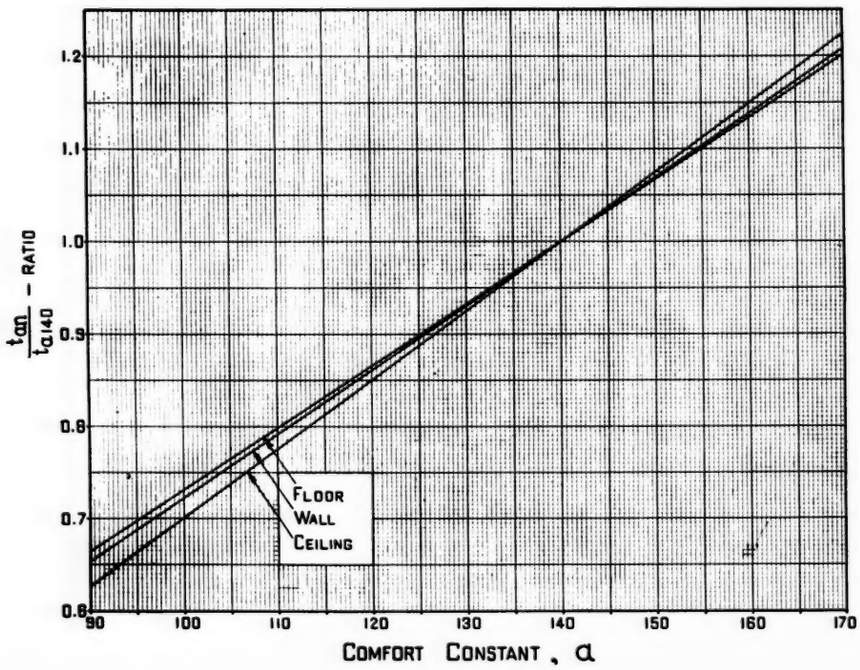


Table 2 — Values for Comfort Constant, a, Under Various Conditions
(a = t_a + MRT)

Conditions	Comfort Constant, a
Foundry	98
Very Active Work	108
Gymnasiums	110
Light Manufacturing	128
Stores and Kitchens	130
Ballrooms	134
Class Rooms	138
Offices and Homes	140
Seated at Ease	142
Hospitals and Bathrooms	150
Swimming Pool	158
Reclining Clothed	162
Reclining Nude	170

Fig. 2. (Left) Effect of Comfort Requirements on Inside Air Temperature.

where subscripts have the same implication as before. Since the designer had previously determined that $t_a = 64.8F$ and $q_t = 31.2$ Btu per (hr) (sq ft) when $a = 140F$, he knows that for $a = 110F$ that $t_a = 50.2F$ and $q_t = 53.3$ Btu per (hr) (sq ft).

As a word of caution, Fig. 1, 2, and 3 are merely *approximations*. Fig. 1 and 2 are quite accurate, averaging about 2% error for panel area and about 1% error for inside air temperature for 35 random cases. The percent error for Fig. 3, panel output, is only 2% for the same 35 cases, but the *development* of the curve is too dependent upon assumption to be very reliable. It is suggested that these figures be used with full realization of their development, and as design curves only when 5% or more error is permissible.

Most publications of design procedures are based on the comfort constant, *a*, of 140F. Fig. 1, 2, and 3 can be used to adjust the design values to any desired comfort requirement. The comfort requirements suggested in Fig. 1 are taken from the literature (3).

Conclusions

The apparently mysterious performance of some radiant heating installations can be explained satisfactorily by a rational analysis employing the cubic equation for panel areas, and an approximation of the effect of comfort requirements on panel design can be obtained graphically.

APPENDIX

A completely rational solution to the problem of determining the effect of *a* on panel area would necessitate differentiating the cubic equation for panel area (2),

$$v^3 DC_e (t_o - t_p) + v^2 (FK + HE - Gh_c) + v (h_rK + FJ) + h_rJ = 0.$$ (See glossary of terms.)

It is seen immediately that the absolute effect depends upon the panel area itself. Such a solution is of no immediate benefit because a very tedious equation remains. In an effort to simplify the problem, a number of numerical problems were solved, these solutions appear in Fig. 4, 5, 6, and 7. Notice that there is no appreciable change in the characteristics of the curves. In other words, Fig. 4, 5, 6, and 7 can be combined into a typical curve for each panel temperature and smoothed by a line of best fit.

This typical curve is shown in Fig. 1, which is a plot of typical values of V_c, U_e, t_o, used in 35 examples of ceiling panel design with t_p varying from 75 to 130F. For ordinates the factor u_n/u_{104} is used so that all curves have a common base point, which is unity.

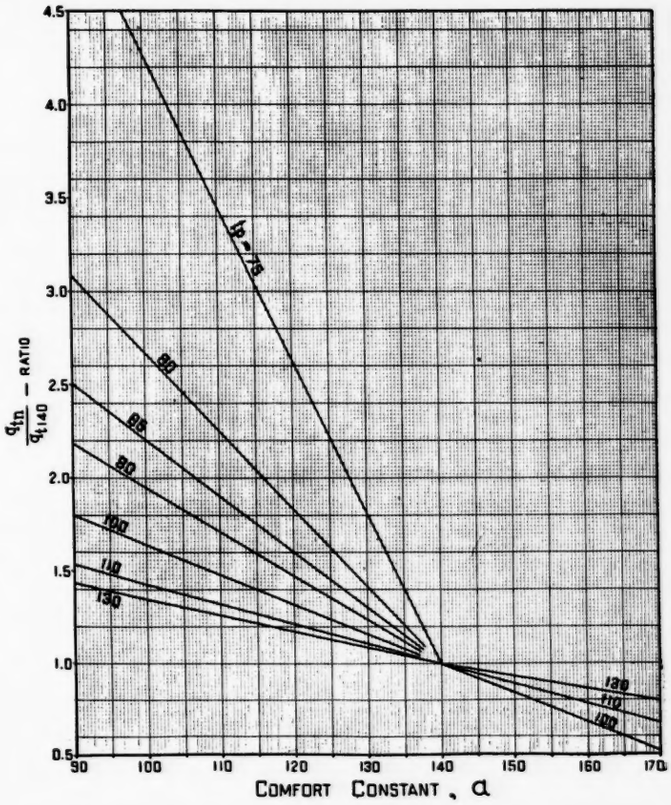


Fig. 3. Effect of Comfort Requirements on Panel Output.

There is certainly no mathematical proof that Fig. 1 is an exact solution for the change in panel area for a given change in *a*, but Table 1 shows the error to be expected is quite small.

For the effect of *a* on panel output and inside room air temperature, still greater simplification is possible. It can be shown that these equations are linear and that simple equations can be developed. The equations for Fig. 2 are derived from the equation for inside air temperature (2) which is:

(1) $t_a (vD + E) - vt_pD + t_pD - 0.018 V_c t_o - a h_c = 0$ (See glossary of terms.)

Differentiating *a* with respect to t_a gives

$$(2) \quad \frac{da}{dt_a} = \frac{vD + E}{h_c}$$

For typical conditions we will assume that 15% of the total surface area is panel area or u = 0.15 and that $\frac{V}{A_t} = 3 = V_c$. The values of h_p and h_c are: *(See next page)*

GLOSSARY OF TERMS

t_a = inside air temperature, F
t_o = outside air temperature, F
t_e = equivalent temperature of unheated area, F
t_p = panel surface temperature, F
a = comfort constant, F
A_t = total surface area, sq ft
A_p = panel area, sq ft
A_e = equivalent area, $A_e = A_t - A_p$, sq ft
U_e = equivalent transmittance, Btu per (hr) (sq ft) (F) (defined as the arithmetic mean of all U values in the room including those for areas not conducting heat)

$$C_e = \frac{1.65U_e}{1.65 - U_e}$$

V = volume rate of air at t_o, passing through the room, cfh

$$V_c = \frac{V}{A_t}, \text{ cu ft per (hr) (sq ft)}$$

$$u = \frac{A_p}{A_t}$$

$$v = 1 - u = \frac{A_e}{A_t}$$

h_c = convection film coefficient of heat transfer for air to non-panel surface area, Btu per (hr) (sq ft) (F)
h_p = convection film coefficient of heat transfer for air to panel surface area, Btu per (hr) (sq ft) (F)
h_r = radiation coefficient of heat transfer from panel to non-panel area, Btu per (hr) (sq ft) (F)
$D = h_c - h_p$
$E = h_p + h_c + 0.018V_c$ where

$$0.018 = \frac{\text{sp. ht. of air}}{\text{sp. vol. of air}} = \frac{0.241}{13.3}$$

$F = h_c - h_r + C_e$
$G = t_pD - 0.018V_ct_o - ah_c$
$H = C_e(t_o - t_p) - t_ph_c$
$J = E(t_p - a) - G$
$K = D(2t_p - a)$
$W = DC_e(t_o - t_p)$
$X = (FK + HE - Gh_c)$
$Y = (h_rK + FJ)$
$Z = h_rJ$

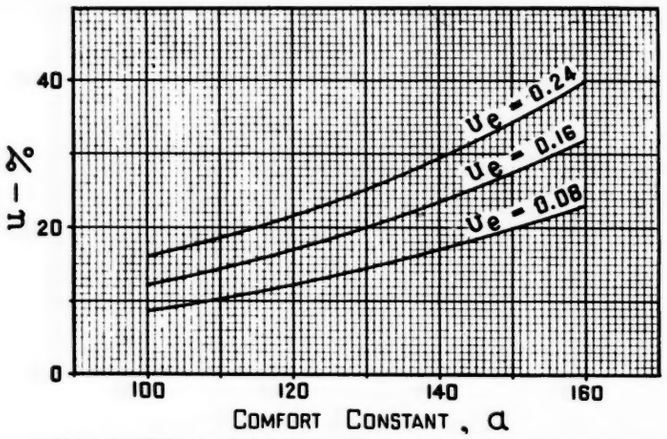


Fig. 4. Effect of Comfort Requirements on Panel Size for Variable Transmittance.

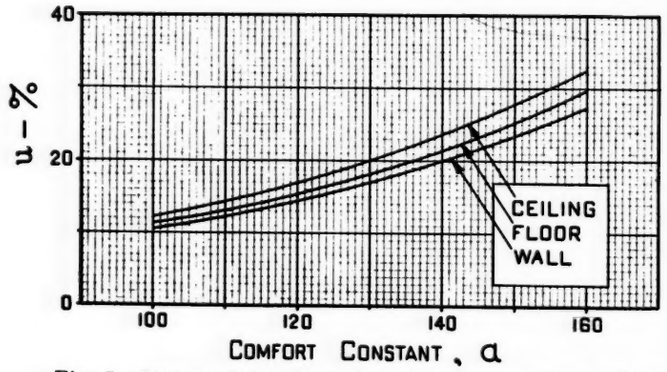


Fig. 5. Effect of Comfort Requirements on Panel Size for Variable Location.

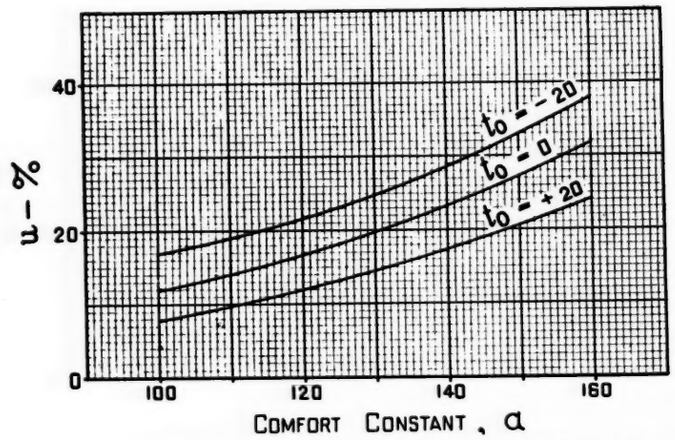


Fig. 6. Effect of Comfort Requirements on Panel Size for Variable Outside Air Temperature.

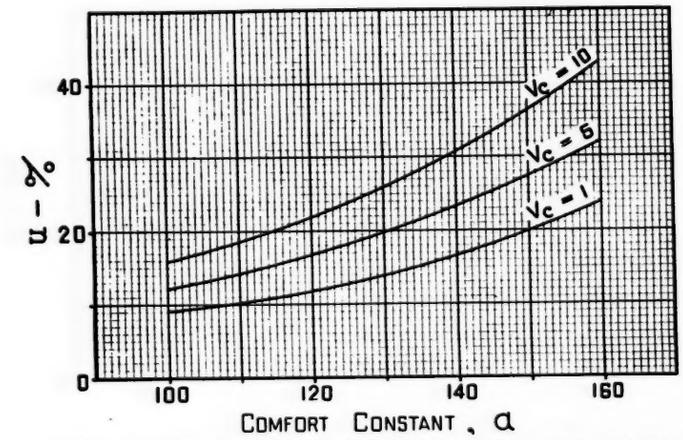


Fig. 7. Effect of Comfort Requirements on Panel Size for Variable Ventilation Rate.

	h_p	h_c
Floor	1.1	0.8
Wall	0.7	0.7
Ceiling	0.4	0.8

Substituting these values in equation (2) gives

(2a) Floor $\quad \dfrac{da}{dt_a} = 2.12$

(2b) Wall $\quad \dfrac{da}{dt_a} = 2.08$

(2c) Ceiling $\quad \dfrac{da}{dt_a} = 2.00$

We may now write the proportion

(3) $\dfrac{t_{an} - t_{a_{140}}}{a - 140} = \dfrac{dt_a}{da}$ and substituting equations (2a) (2b) and (2c) in (3) gives numerical values (1/2.12 for floor panels, etc.) for the indicated ratio of differences between air temperatures and comfort constants.

Using these values and selecting typical values of $t_{a_{140}}$ as 71F for floor panels, 69F for wall panels, and 67F for ceiling panels the following three equations may be derived:

(4) Floor: $\dfrac{t_{an}}{t_{a_{140}}} = \dfrac{a + 8.4}{148.4}$

(5) Wall: $\dfrac{t_{an}}{t_{a_{140}}} = \dfrac{a + 3.52}{143.52}$

(6) Ceiling: $\dfrac{t_{an}}{t_{a_{140}}} = \dfrac{a - 6.00}{134.00}$

Equations (4), (5), and (6) are plotted in Fig. 2.

Similarly, for plotting Fig. 3, the basic equation for panel output in references (1) and (2) is found to be

(7) $q_t = h_r\ (t_p - t_e) + h_p\ (t_p - t_a)$

Since both t_e and t_a involve the constant a, they can be so written as to allow differentiation of q_t with respect to a, and it will be found that

$$(8)\quad \frac{dq_t}{da} = -\left(\frac{h_r}{v} + \frac{h_p h_c}{vD + E}\right) = m$$

(The sign of m tells us that q_{tn} decreases as a increases.)

We may write the proportion

$$\frac{q_{tn} - q_{t_{140}}}{a - 140} = m$$

which may be written

$$\frac{q_{tn}}{q_{t_{140}}} = \frac{m(a - 140)}{q_{t_{140}}} + 1 \quad \text{or}$$

$$q_{tn} = 1 - \frac{(a - 140)\left(\dfrac{h_r}{v} + \dfrac{h_p h_c}{vD + E}\right)}{q_{t_{140}}}$$

Equations of this type are plotted in Fig. 3.

References

(1) Raber, B. F., and Hutchinson, F. W., *Panel Heating and Cooling Analysis*, John Wiley and Sons, Inc., New York, 1947.

(2) Chapman, W. P., and Fischer, R. E., Graphical Solution of a Direct Equation for Radiant Panel Areas, *Heating and Ventilating*, January, 1948.

(3) *Heating and Ventilating's Engineering Databook*, The Industrial Press, New York 13, N. Y., 1948, pp. 5-43 and 5-49.

Comments Regarding the

Maintenance and Use of Controls

NATHAN N. WOLPERT
Associate Editor, Heating and Ventilating

Findings of a survey made to determine experiences with the maintenance of controls, and the preference for specific types of controls.

CONTROLS are sensitive mechanisms which require specialized knowledge not only for their design, but also for proper maintenance and satisfactory installation.

These controls must be intelligently serviced after they are in operation. A lack of proper servicing, due to inadequately trained service men, has resulted in some unfavorable experiences, although many engineers have had little difficulty with controls.

Since it is always interesting to learn the experiences of others with specific design and operating problems, letters were sent to one thousand readers in order to obtain their comments regarding the four questions in the box on this page.

Maintenance and Servicing

A summary of experiences regarding maintenance, servicing and operation of controls indicate that the chief cause of complaint is due to inadequately trained service men or to problems relating to servicing.

Although 19.4% reported that they had little difficulty with controls, 13.9% indicated that most of their unsatisfactory experiences with controls were due to inadequately trained service men; 8.3% reported servicing was too costly; 5.5% that the servicing by manufacturers was not satisfactory; 5.5% that setting and coordinating require too much time and check-up; 5.5% that there could be better consumer education by the manufacturer. Of equal importance were the facts that inexperienced maintenance men tamper with the controls; instructions issued by the manufacturer are difficult to follow; controls can only be serviced by factory-trained men; controls are poorly constructed, and controls have too many moving parts.

Other comments noted were the facts that: Controls are too complex; there is insufficient inspection by the manufacturer; it is difficult to prevent tampering; manufacturers are more interested in selling than in application and servicing; poorly trained salesmen are unable to supply necessary information.

Here Are the Questions Asked

1. **What have been your experiences with maintenance, servicing and operation of controls?**
2. **Have you need for some specific control, not now available?**
3. **What are your comments regarding the use of zone control as against individual radiator controls?**
4. **In your opinion, why is there not a more general use of indoor-outdoor heating controls?**

The following comments were taken from some of the replies received to this question. Names are purposely withheld but occupations are given so that the information may be properly interpreted.

Chief Engineer, Hotel, New York—In general, controls are too complicated, delicate, and have too many moving parts that require both attention and frequent adjustments. Some controls are too limited in range and adaptability. Some are too easily rendered inoperative by well-meaning but inexperienced maintenance men. Most controls require factory-trained servicemen to make any but the simplest adjustments.

Engineer, North Tarrytown, N. Y.—It appears that most jobs are at the mercy of the service engineer of the manufacturer, since usually the operating engineer is inadequately fitted to properly maintain and service the controls. A better educational job should be done by the control manufacturers.

Consulting Engineer, Chicago, Ill.—By their very nature, controls are so complicated that it requires an expert to work on them. Although the average service and installation men are able to get them working after a fashion, the time required is out of proportion to the results. The difficulty is that mechanics cannot comprehend instructions by reading. They must be shown. Factories should have field men who teach employees of contractors and service companies. However, I have spent hours with factory representatives and still could not get the information I needed about controls. Minneapolis-Honeywell tried movies and lectures several years ago, but the men did not benefit too much because they learn best by actually handling the controls and trying them out under practical conditions.

Electric and Gas Utility, Nebraska—Customers do not realize the great number of times that controls cycle and that eventually they will wear out. Without this understanding, many are disgruntled when they are advised that the manufacturer has declared their 15-year-old control obsolete and will no longer repair or furnish repair parts for it. Many do not receive this information well. The manufacturer should carry on an educational program on this point if they are going to retain the replacement business.

Chief Engineer, Board of Education, Minnesota—Owners and managers have been sold on the installa-

tion of a temperature control system without being informed that the system should be under the supervision of a proficient service man. This results in a great deal of dissatisfaction—the manufacturer is blamed rather than the lack of proper supervision.

Engineer, Consulting Engineer's Office, Buffalo, N. Y.—Generally, servicing of controls by the control company that made the original installation is not good. There seems to be a lack of skilled service men. Operation of air conditioning controls are dependable but the proper setting of controls and coordinating of same takes longer than it should and it generally requires considerable follow-up before the system is satisfactory.

Design Engineer, Electric Utility, Illinois—A great majority of control vendors have good salesmen but no one to give on-the-spot information. They always have to refer to the factory. This delays work several weeks. A good engineer would be appreciated.

Sales Engineer, Air Conditioning Company, Philadelphia, Pa.—Trouble results from inadequately trained service personnel and inefficient inspection by the manufacturer.

Chief of Maintenance, Housing Administration—Maintenance and servicing of controls is no better than the personnel doing the work. However, there are many good controls that need very little service work, and there are controls that cannot be kept in condition. I have both kind but I find the best type of controls, either indoor or outdoor, are those with the least amount of moving parts.

Chief Engineer, Gas Burner Manufacturer, Buffalo, N. Y.—Practically all my experience has been with controls used with gas burning equipment. Generally speaking, controls when properly applied are remarkably dependable and require a minimum of service. Some controls are troublesome because of impurities found in some gases, particularly manufactured gases. Under such use, these controls require more attention than others. Safety pilots are in most cases responsible for approximately 80% of automatic equipment failures. There is plenty of room for improvement.

Heating Engineer, Portland, Ore.—Most service calls on heating systems and burners are control troubles. By standardizing on one make of controls, the men learn the controls and their weak spots. Therefore, time is saved in servicing.

Engineer, Boise, Idaho.—High grade, soundly engineered controls have presented no difficulty worth mentioning. So-called competitive controls have lead to dissatisfaction and usually to early replacements with quality products.

Suggested Controls

Although 58.8% of those who replied did not have need for some specific control not now available, the suggestions received from the others are many and varied. They include:

Trouble-free modulating controls.

Simple control of dew-point temperature of air.

Economical radiant heating control.

Thermostat control to operate fan motors.

Humidistat worth installing.

Simple, fast-acting safety pilot with automatic electric ignition.

Individual controls for hot water radiators.

Control which will hold back delivery of oil to burner until there is an ignition spark and heating unit is vented.

Two-wire equivalent of the M-H 447A-summer-winter job.

Good mechanical limit control for warm air furnaces.

Combination warm air limit and fan switch somewhat similar to the White-Rodgers No. 566, designed to fail safe.

Electronic control sensitive to radiant energy rather than air temperature.

Pneumatic solenoid valve.

Control for small fan burners for one- and two-family homes that would eliminate a constant pilot light.

Simple, not too costly high limit cutout switch to protect against excessive temperatures at two or more locations.

A multi-flame protection unit with a sensing device adaptable to either gas or oil flames.

Moderately priced modulating control for banks of electric heating elements.

One engineer with a control manufacturer wrote, "I believe there is a real need for a thermostat for the control of radiant heating systems. This thermostat should respond to the radiant effect rather than to the sensible heat gain of the room. There is no such instrument on the market for general use at this time."

Zone or Individual Radiator Control

Replies to Question 3, regarding the use of zone control as against individual radiator control, indicated that 38% were in favor of zone control and 17.4% were in favor of radiator control. The balance, or 44.6% did not take a sharp stand either way. Of this 44.6%, 15.2% had no experience with such controls or did not care to make any comment.

Concerning use in office buildings, 6.5% believed that individual radiator control was best; 4.4% considered zone control more desirable. For apartment buildings, 6.5% believed that zone control was best.

As many as 15.2% indicated that the decision between zone and individual radiator control was influenced by the cost of the two systems. Although 17.4% said that zone control was cheaper than the other type, only 6.5% emphasized that zone control was simpler. Other reasons why zone control was preferred were that maintenance was simpler and that fewer controls were required.

Design Engineer, Electric Utility, Chicago, Ill.—Zone control is better for an even overall temperature; radiator control is spotty and requires more maintenance.

District Manager, Control Company, Portland, Ore.—Zone controls are used most often in lieu of radiator controls where there is not sufficient money to provide

a more expensive individual radiator control. A combination of both controls is of course very good. However, the use of zone control systems has as its prime feature, a saving of fuel.

Consulting Engineer, Reading, Pa.—On vapor work in schools, offices and institutions we prefer individual radiator controls. For apartment houses, large residences, etc., and for radiant panel design, we use zone controls.

Engineer, Electric and Gas Utility, Nebraska—The more the control of conditions can be broken down, the better the operation. A good individual radiator control system should prove superior to zone control. Again cost has to be justified, so more often a compromise is made by installing zone controls in preference to the other type.

Chief Engineer, Hotel, New York, N. Y.—The combination of the two has proven very successful in a number of installations that I have operated and maintained. Employing both zone and separate radiation control in combination so that they can be operated together or/and separately, makes for flexibility of operation, closer control and greater economy in operating costs.

Chief Engineer, Board of Education, Minnesota—There are places where the zone control is sufficient for the type of occupancy. However, in places where more accurate temperatures are required, and where different temperatures in various rooms are required, the individual room control is essential.

Consulting Engineer, Chicago, Ill.—We have repeatedly used zone control in lieu of individual control because of cost. The operation has been entirely satisfactory but there is no doubt in my mind about individual control being preferable.

Supervisor, Steam Utility, Pennsylvania—From the first cost and economy standpoint, the fewer the number of zones, the lower the first cost and maintenance expense. Usually the steam or fuel saving made with a single zone control gives the greatest return per dollar invested in the control facilities. Therefore, it appears that as the number of zones increases, comfort and convenience also increase, but charges are partly if not entirely offset by increased fixed charges and additional maintenance. The choice, therefore, depends on the building owner's attitude toward these factors.

Engineer with Consulting Engineer, Buffalo, N. Y.—Zone control costs less to install and functions well where temperature requirements are the same for the zone. There are fewer mechanical controls to require maintenance. Greater fuel economy is afforded for the high vacuum system. Individual radiator control is best where the individual room temperature varies considerably in the building.

Engineer, North Tarrytown, N. Y.—Use of individual radiator controls will and does provide the ultimate in temperature control, far exceeding the results obtainable with zone control. At its best, zone control requires exact sizing of radiators and/or adjustments of orifices to obtain effective results. Zone control, combined with an indoor thermostat, unless located in a representative spot, will not compensate for solar effect.

Indoor-Outdoor Heating Controls

The reason that there is not a more general use of indoor-outdoor control (Question 4), according to 44% of the replies received, is that the user is not educated to the value and importance of this control. On the other hand, 16% believe that the various companies could do a better selling job.

While 13% of the replies to this question indicated that there should be a much wider use of this control, 8% mentioned that greater maintenance will be required, and 36% stated that curtailment in the use of the indoor-outdoor control was due to cost. For radiant heating systems, 6% considered this type control essential. Other comments were that it was a luxury item; the instrument response was slow; steam savings do not match the claims for this control; homeowners were too satisfied with existing controls; it is too complicated.

Here are some of the comments regarding this question:

President, Heating Company, Watertown, N. Y.—Due to the lack of constant advertising by the manufacturers and retailers, indoor-outdoor controls are not generally used.

Manager, Control Company, Portland, Ore.—I feel that there is not a more general use of indoor-outdoor controls because of the fact that contractors are not yet thoroughly sold on the idea. I believe this phase of the temperature regulation business should be more thoroughly advertised.

Chief Engineer, Board of Education, Minnesota—The advantage of an indoor-outdoor control over a good, well supervised standard system in many of the buildings, is not sufficient to warrant the additional cost.

Consulting Engineer, Chicago, Ill.—Every system designed in this office uses some application of indoor-outdoor control. I was not aware of the lack of general use of this feature. If true, it can only mean that the profession has not been educated on this application.

Chief Engineer, Appliance Company, Buffalo, N. Y.—Manufacturers have priced their controls right out of the reach of the general public. The average man will not spend money for controls and high installation cost for advantages claimed. There are more opportunities to attain comfort heating, particularly warm air, by use of more sensitive room thermostats and continuous air circulation, at little or no additional cost over present indoor controls.

President, Heating Distributor Company, Seattle, Wash.—The biggest drawback to the indoor-outdoor control is that it is impossible in many cases to sell the control for a sufficiently high price installed, to include enough to cover adequate engineering, proper installation, necessary adjustments, and the very important education of the occupants of the house or apartment on which the control is installed, as to the operation of the control.

Engineer, Heating Company, Cleveland, Ohio—In my opinion, modern controls are sensitive enough to compensate for even sudden temperature changes and therefore the only system which could economically utilize indoor-outdoor heating controls are large apartment or office buildings, where large heating loads are caused by morning demands.

Engineer, Board of Education, New York—I believe it is a question of educating and/or selling the operator in such a manner that he will be able to distinguish the sheep from the goats in the control field. I have no doubt that the indoor-outdoor combination is the best heat control basis. However, the public must be acquainted with this control.

Supervisor, Steam Utility, Pennsylvania—I believe that indoor-outdoor controls in our district are being more generally used. Some heating systems are so small and simple that a single thermostat and its complementary control device are adequate and at the same time less expensive. Therefore, it is the type of control most generally used on small heating systems. For a larger and less simple heating system, a single room thermostat per zone is not very satisfactory as a main control device. A more expensive control can be justified on a large system. Since most of these better controls employ the indoor-outdoor principal of operation, it appears that as the number of more expensive controls sold increases, the number of indoor-outdoor controls used will also increase. In other words, I believe the number of such controls used depends on the selling or advertising effort behind it.

Engineer, Heating and Air Conditioning Contractor, Lincoln, Neb. — In my opinion there is not a more general use of indoor-outdoor heating controls because new installations are generally let on a fixed contract basis, and the extra refinement adds to the cost. Again, the general public and the average heating contractor are not educated to the benefits of such a control. As many residences have direct-fired warm air heating systems, they do not require the indoor-outdoor control.

Explosion-Proof Gas House Heaters*

Recurrent minor injuries to personnel at a western weather observation station, from the failure, or handling, of very cold balloon-inflation equipment, led to experiments with heaters for the hydrogen house that would keep the temperature within a comfortable range and still not constitute a fire or explosion hazard should a tank of hydrogen leak.

Although a forced circulation hot-water heating system would probably be the ideal solution to the problem, labor requirements and initial cost made alternative construction necessary. Tests showed that an electric heating system, with forced air circulation, could be equipped with Davy screens in the air ducts, so as to be entirely safe for this purpose.

The housing was made of 1/16 in. sheet steel, bent and spot welded. The interior of the case was insulated with ½ in. transite sheeting, bolted in place. Strip heaters were supported above the transite with bushings, to permit even radiation and air circulation. Air ducts were of 2 in. thin-wall electrical tubing, which, because of its smooth interior, is about as effective as 3 in. stovepipe. The centrifugal blower was an overvolted automobile heater blower. A more rugged blower, having a ¼ hp motor, would be more suitable.

Electrical control of the heaters and blower is obtained through a thermostat mounted in the cold air intake duct. This is a commercial single-pole double-throw bimetallic thermostat. Coupling the thermostat to the heaters and power line is a relatively new control mechanism, so arranged that no heater power passes through the thermostat contacts, and no current flows in the initial control circuit except at the instant of change. When the thermostat makes contact for the first time on either side, the latching relay changes position; additional closures of the same contacts produce no further effect. This arrangement makes for long contact life and and minimizes radio interference.

As the centrifugal blower need only operate when the heater is on, the step down transformer supplying it is shunted across the heaters. Use of a continuously operated fan was considered, but as thermal stratification within the gas house was not objectionable, intermittent operation was deemed adequate.

Because of a large radio installation in the vicinity of the gas house, spark absorbers, consisting of a 2-mf paper condenser and a 100-ohm resistor, were shunted across all contacts. This arrangement, plus enclosure of all power wiring in steel conduit, plus careful grounding of the secondary circuit, eliminated all radio interference.

Tests of this heater during the coldest weather of a mountain winter showed that it could keep the temperature inside the gas house more than 100F above that outside with about 50% operation. This allows an adequate margin of safety for any conditions likely to be encountered anywhere.

When an explosive mixture of hydrogen and air was passed through the heater, it could be intentionally ignited at any point, but the ignition would not spread past a Davy screen. It was not found possible to ignite the gas within the heater by means of the electrical connections until an arc was deliberately produced. This would not normally occur in use, and could last only a short time, as the fuses would blow.

Maintenance consists of removal of sand from the air ducts monthly, and cleaning of the relay contacts occasionally. Life of the heaters and motor is about one year of continuous service, or more than two years of intermittent service.—*Ronald L. Ives.*

*Condensed from the *Bulletin of the American Meteorological Society.*

Progress Report on a
HEAT PUMP WATER HEATER

PHILIP SPORN, President, and
E. R. AMBROSE, Air Conditioning Engineer
American Gas and Electric Service Corporation

The heat pump air conditioner for maintaining year-'round comfort in residences, commercial establishments, and office buildings has received a considerable amount of attention during the past few years. However, very little thought has been given to the design and manufacture of a heat pump water heater for the heating of the domestic water supply. It is believed by many that this device has possibilities equal to if not greater than those of the heat pump air conditioner, at least so far as the immediate future is concerned.

Progress Report on a

Heat Pump Water Heater

PHILIP SPORN
President
and
E. R. AMBROSE
Air Conditioning Engineer
American Gas and Electric Service Corporation, New York

THE heat pump water heater is readily adaptable to a self-contained package device which can be manufactured by quantity production methods and techniques. The cooling effect produced by the evaporator can be used to reduce the temperature in a space, thereby obtaining double duty of cooling the space while simultaneously heating the domestic water supply. Also, a heat pump water heater with a coefficient of performance of 3.5 to 4 should be competitive in operational costs with the more common fuels, coal, oil, and gas, in many sections of the country. In addition, it possesses all the advantages cited for a heat pump unit, such as no products of combustion, no chimney, no odors, no soot, no possibilities of explosion, plus the ability to automatically furnish heating as well as cooling.

The most serious handicap facing this device, when compared with the more conventional hot water heating units, is the first cost. If the unit can be designed and assembled for quantity production so that the manufacturing cost will be a minimum and at the same time effectively use the cooling effect available, then the first cost will no longer be an insurmountable obstacle. To receive wide public acceptance, a substantial amount of time and effort must be made in research development and design of the unit in order to properly correlate the various requirements and produce a device having five basic qualities:

(1) High reliability.
(2) Economical performance. The unit must be highly efficient and subject to inherently low maintenance cost.
(3) Reasonable first cost.
(4) Compactness.
(5) Neat appearance.

Some engineering investigations and studies are now under way on

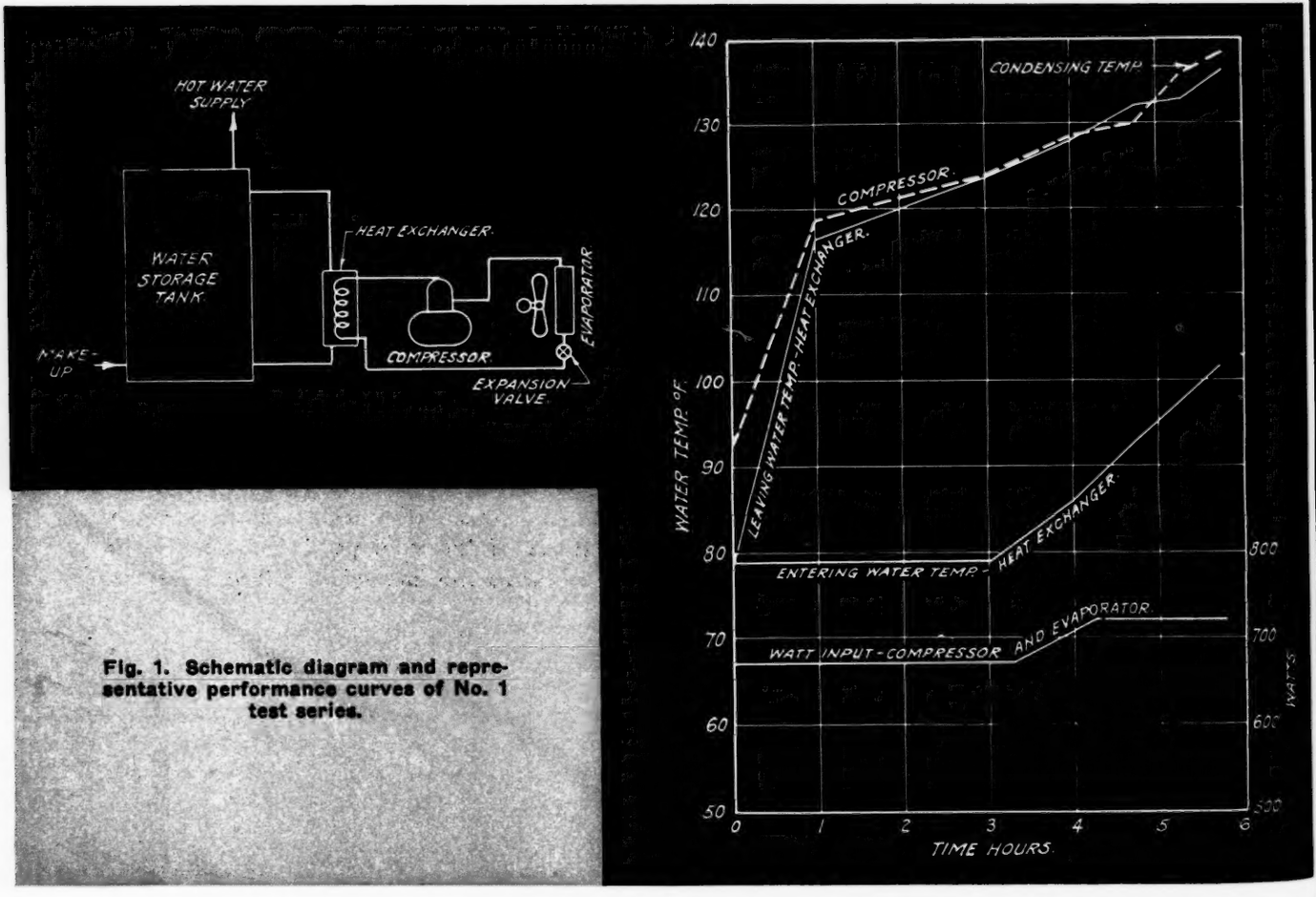


Fig. 1. Schematic diagram and representative performance curves of No. 1 test series.

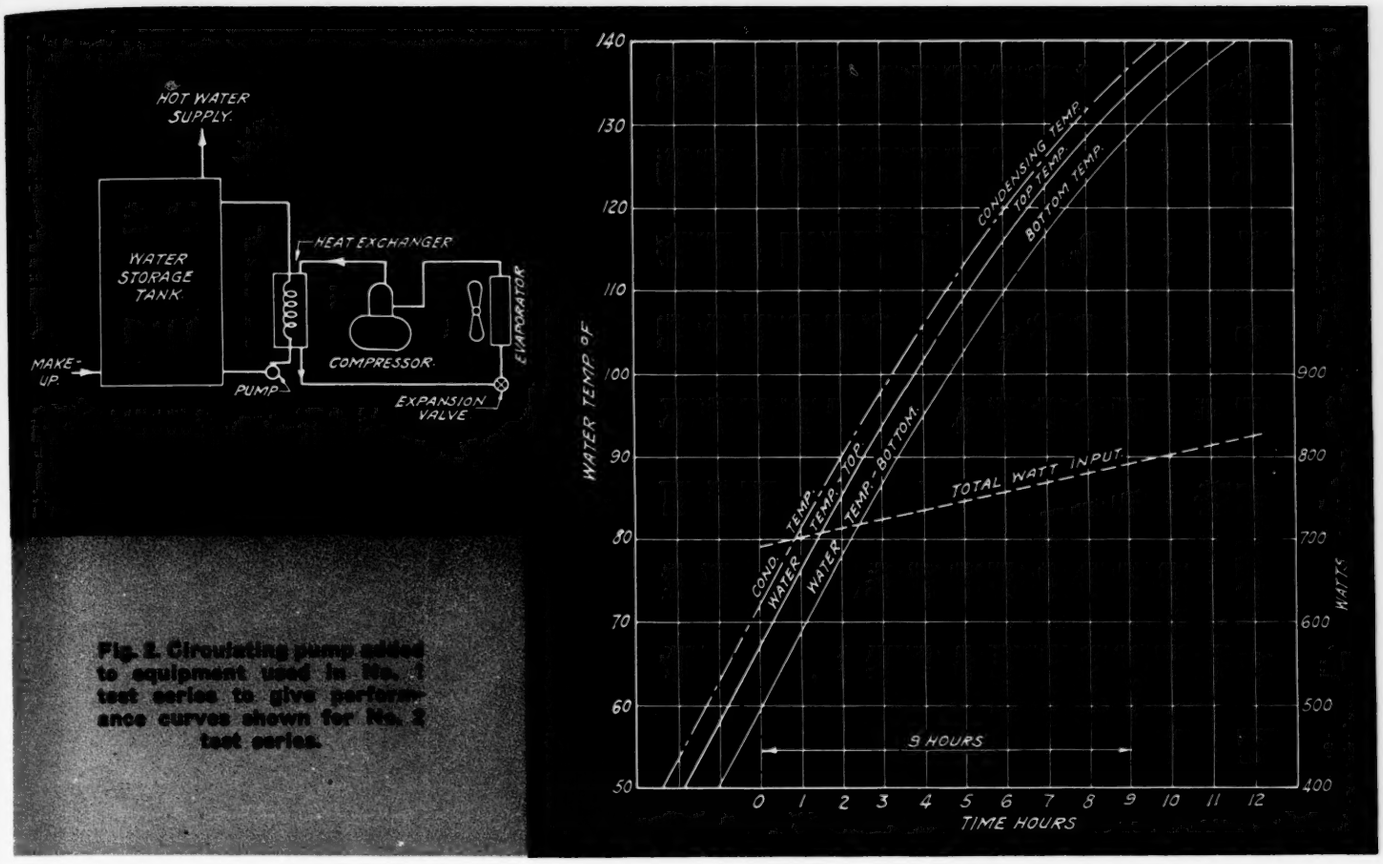


Fig. 2. Circulating pump added to equipment used in No. 1 test series to give performance curves shown for No. 2 test series.

the heat pump water heater and at least two manufacturers have assembled laboratory models for observations and tests. However, these investigations and studies have not been too active to date and consequently there has been very little advancement made in the development of a unit. The American Gas and Electric Co. and subsidiary companies, consisting of Appalachian Electric Power Co., Indiana and Michigan Electric Co., Kentucky and West Virginia Power Co., Inc., Kingsport Utilities, Inc., The Ohio Power Co., and Wheeling Electric Co., believe that the heat pump water heater holds sufficient potentialities to warrant an active program of research and development. Toward this end an extensive investigation has been made to determine the probable design and operational difficulties. A number of performance tests were conducted on three different developmental designs of heat pump water heaters to obtain actual performance data.

The first design tested consisted of a ½-hp open type compressor, forced air evaporator, and a water-refrigerant heat exchanger, all located externally to an 86-gallon water tank. In some of the tests the thermal head, due to the entering and leaving temperature differentials, was employed to circulate the water between the heat exchanger and the tank. In other tests a small pump was used to provide forced circulation between the heat exchanger and the water storage tank.

In the second design the condenser or water to refrigerant heat exchanger was located directly in the bottom section of the water tank. The compressor and evaporator were located externally to the water tank, similar to that employed for design No. 1.

In the third design a hermetically sealed, Freon-12, ½-hp compressor was mounted directly in the top portion on the water tank and the condenser in the bottom portion. The evaporator was located externally to the water tank.

Of the three designs tested, it appears that the hermetically sealed unit mounted directly in the water storage tank offers the most promising possibilities for obtaining a practical heat pump water heater. With this arrangement, it was possible to obtain an average heating rate of 7700 to 8020 Btu per hr using an initial water temperature of 60F. In the draw-off tests made, the final water temperature in the top compartment was between 142 and 155F, and the coefficient of performance between 2.86 and 3.46 based on energy input to the compressor motor only, and 2.47 and 2.93 based on energy input to the compressor motor and all auxiliaries.

Equipment and Performance

No. 1 Test Series—The first domestic heat pump water heater was assembled and tested during July, 1946. The schematic equipment diagram and the representative performance are given by Fig. 1. The equipment used in the assembly of this first model consisted of a conventional 86-gallon electric water heater (less the electric heating elements), a refrigerant-water heat exchanger, a finned type evaporator, and a ½-hp open type compressor operating at 680 rpm. In this series of tests the 39F average temperature differential between the water entering and leaving the heat exchanger indicated that forced circulation is required. The average entering air temperature to the evaporator was 77F, and the

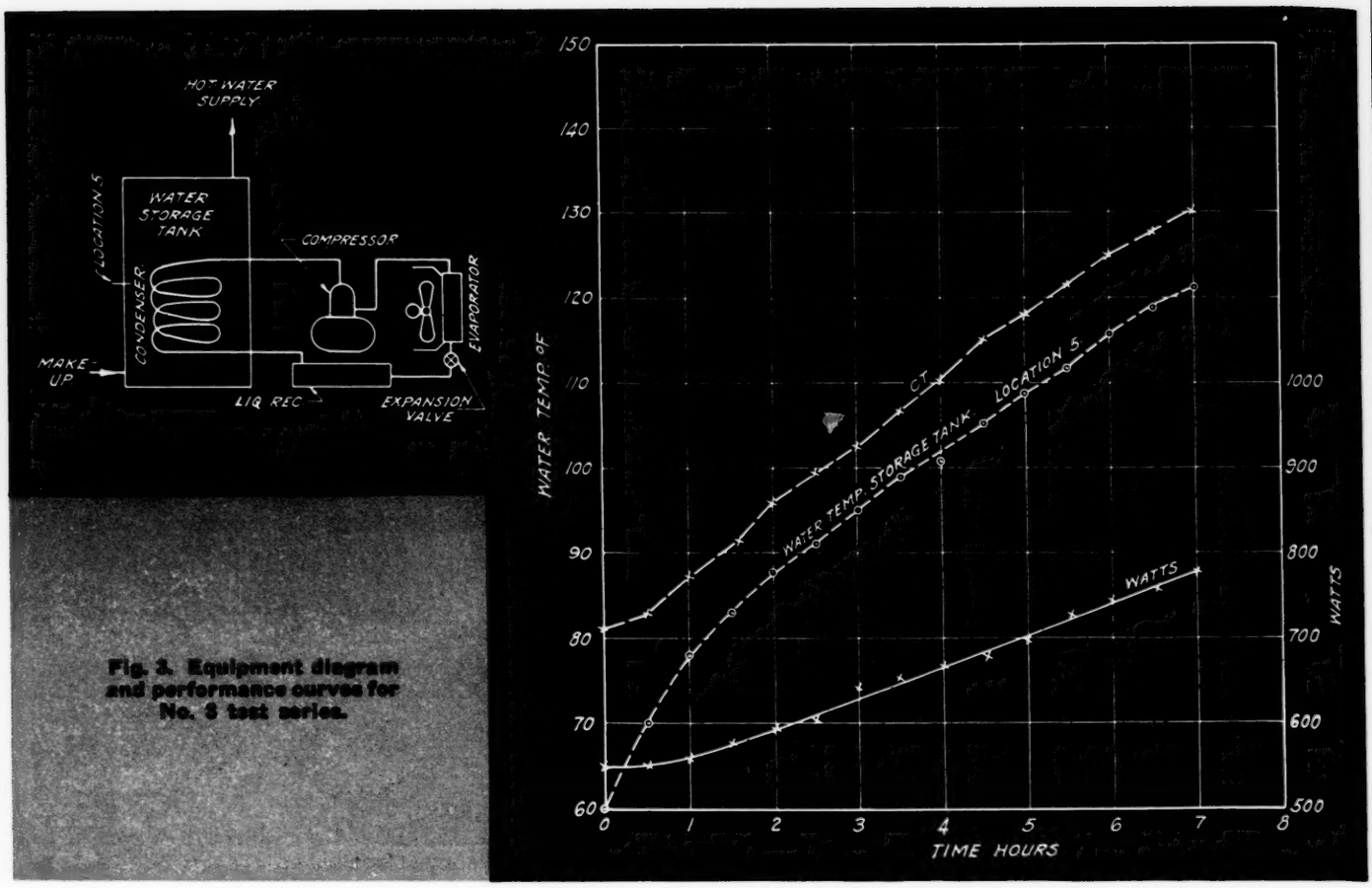


Fig. 3. Equipment diagram and performance curves for No. 3 test series.

average air flow over the evaporator was 510 cfm.

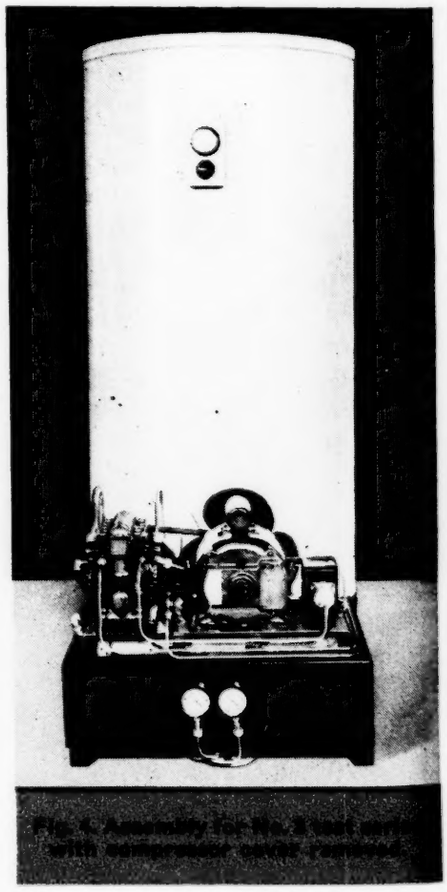
At the end of 5¾ hours the water in the top of the tank was 136F and in the bottom 102F giving an average tank water temperature of 119F. The average water heating rate was 4630 Btu per hr, and the average coefficient of performance (including energy input to the compressor motor and all auxiliaries) during a typical cycle was 2.1.

No. 2 Test Series—Test series No. 1 indicated that forced circulation through the heat exchanger would be necessary to maintain a reasonable water inlet and outlet temperature differential. In order to obtain the performance when using forced circulation, a small circulating pump was installed on the intake side of the exchanger. The schematic diagram and a representative performance curve are given by Fig. 2. The same equipment used in No. 1 test series was used, except a water circulating pump was added. The average entering air temperature to the evaporator was 78F, and the average air flow over the evaporator was 510 cfm.

In this test series the temperature difference between the water entering and leaving the heat exchanger is 5.7 which is a big improvement over the 39F obtained in No. 1 test series. At the end of a nine-hour period the water in the top of the tank was 133.7F and in the bottom 129.2F, giving an average tank water temperature of 131.5F. The water heating rate was 5450 Btu per hr, and the average coefficient of performance during a typical cycle (including energy input to the compressor motor and all auxiliaries required by the water circulating pump) was 2.2.

No. 3 Test Series—In this series of tests run from March to December, 1947, the refrigerant-water heat exchanger (condenser) was located directly in the water tank in order to try to improve the coefficient of performance. The schematic equipment diagram and the representative performance are given by Fig. 3.

The equipment used in the assembly consisted of the same conventional 86-gallon electric water tank (less the electric heating elements), a condenser located directly in the water tank, a finned type evaporator, and a ½-hp open type compressor. The condenser consisted of 65 ft of ⅝-in. O.D. tube assembled to make an inner and an outer coil.



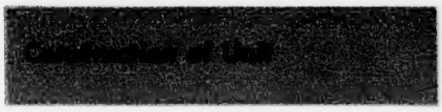
A photograph of the assembly, less the evaporator, with the compressor cover removed is shown by Fig. 4. A photograph of the unit completely assembled is shown by Fig. 5. The compressor and evaporator are the same as used on Nos. 1 and 2 test series.

To find the water temperature variation from the bottom to the top of the tank, eight thermocouples were located in the water storage tank. It was found that the water temperature variation, except for the bottom ten inches, was seldom more than 3F. Since one of the thermocouples was found to represent the average tank water temperature, it was used to compute the performance of the unit.

In this series of tests the water temperature in the storage tank averaged 10F below the condensing temperature. At the end of seven hours the average tank water temperature was 121F. The air flow over the evaporator averaged 435 cfm. The average air temperatures entering the evaporator was 65F. The evaporator fan motor and refrigerant liquid solenoid valve require 80 watts. The water heating rate was 6100 Btu per hr, and the average coefficient of performance during a typical cycle was 2.68 using energy input to the compressor motor only, and 2.40 using compressor input to the compressor motor and all auxiliaries.

Nos. 4a and 4b Test Series—In this series of tests the compressor as well as the condenser was located directly in the water tank. The schematic equipment diagram and the representative performance for 4a test series are given by Fig. 6.

The equipment for the unit consisted of a standard 80-gallon electric water tank (less the electric heating elements), a copper condenser coil, an evaporator, and a 2-cylinder hermetically sealed F-12 compressor driven by a ½-hp, 115-volt, 60-cycle motor.



In order to locate the compressor in the water tank, the casing and insulation were removed and two angle iron flanges were welded to the bare tank approximately one-third from the top. The tank was then cut in two between the two flanges. Fig. 7 is an interior view of the bottom part of the water tank showing the condenser. The condenser consists of approximately 100 ft of ⅝-in. O.D. copper tube in the form of a coil supported by ¼-in. rods welded to the coil loop.

The compressor is supported by a circular steel plate fastened to the bottom section of the tank. The steel plate contains two one-inch diameter holes to permit water flow from the bottom to the top section. To make the conduit for power supply water-tight, the terminal box and the loop of ⅝-in O. D. tube was filled with a compound having a high melting point. The tube connections on the bottom section of the tank are refrigerant pressure connections.

Fig. 8 shows the assembly with the top of the tank secured in place and the insulation removed. Net capacity of the tank was 75 gal.

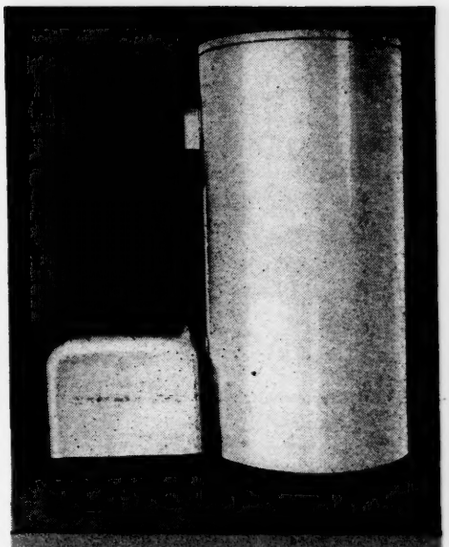
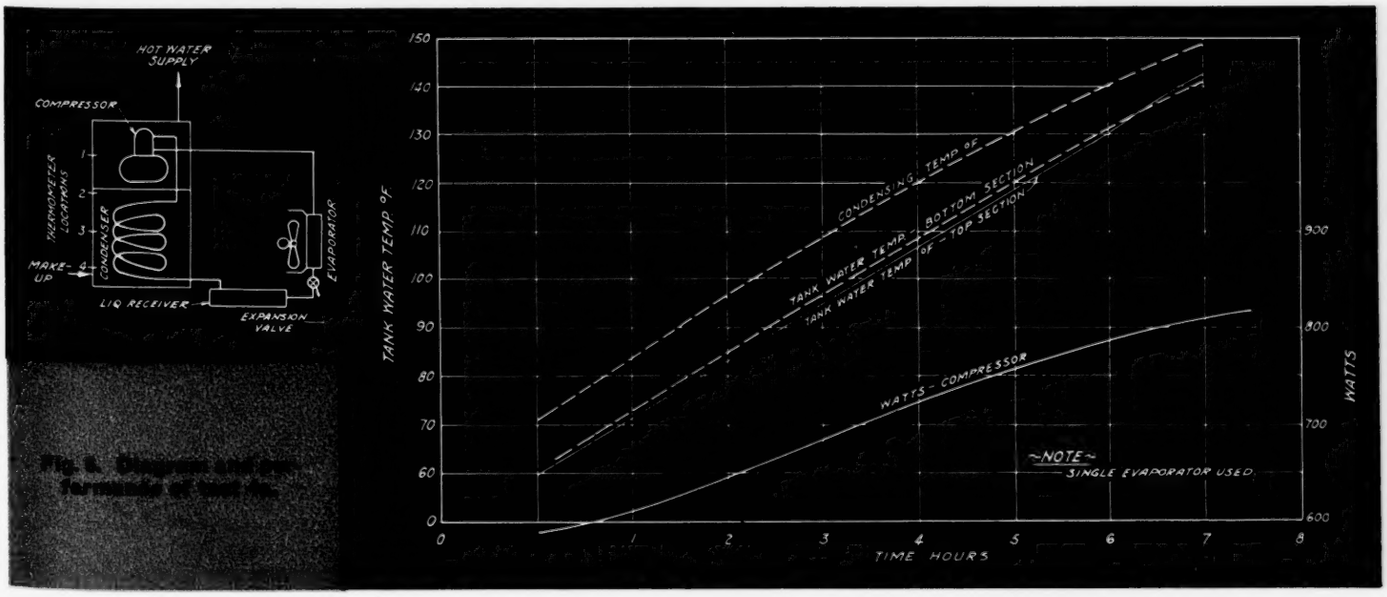


Fig. 5. Completely assembled unit for No. 3 test series.

Fig. 9 shows the water heater fully assembled. The evaporator unit consists of a ⅛-hp blower and a 2-row cooling coil. Subsequently, an additional 2-row cooling coil, identical to that shown, was added to the system. Refrigerant accessories shown in Fig. 9 include a thermostatic expansion valve, solenoid valve, refrigerant drier, pressure gauges, and a high-low pressure cutout.

The water temperature variation from the bottom to the top of the tank was measured by four thermometers. Thermometer No. 1 was located in the middle of the top section and the other three were equally spaced, vertically, in the



bottom section. The water temperature variation in the bottom section was as much as 11F on occasions because the condenser did not effectively heat the bottom twelve inches of the tank. The water temperature of the bottom section of the tank, given in Fig. 6, is the average of the three temperatures.

In a representative performance test of this series, at the end of seven hours the average water temperature in the top section was 142F and in the bottom two sections 144F and 134F, giving an overall average of 140F. The water heating rate was 8020 Btu per hr, and the average coefficient of performance during a representative cycle was 3.46 for the compressor only, and 2.93 for the compressor plus auxiliaries.

The air flow over the evaporator averaged 580 cfm. The air temperature entering the evaporator averaged 72F. The evaporator air entering-leaving temperature differential was 10 to 13F, and the saturated refrigerant suction temperature was 41 to 48.5F. The evaporator fan motor and solenoid valve required 125 watts.

Fig. 10 gives the performance of the heat pump water heater after a second evaporator coil was added (4b test series); otherwise, the equipment is the same as used to obtain performance shown by Fig. 6. At the end of five hours the average water temperature in the top section was 148F and in the middle section 145F. The water temperature in the bottom section was 80F. This low water temperature in the bottom section was due to an excessive refrigerant charge in the system which later was corrected. The water heating rate was 7700 Btu per hr, and the average coefficient of performance was 2.95 for the compressor only, and 2.55 for the compressor plus auxiliaries.

The air flow over the evaporator averaged 580 cfm. The air temperature entering the evaporator averaged 59F. The evaporator air entering-leaving temperature differential was 10F, and the saturated refrigerant suction temperature was between 49 and 52F. The evaporator fan motor and solenoid valve required an estimated 125 watts.

No. 5 Test Series—The entire tank of water was heated in test series 1 to 4 starting with a cold tank of water at a temperature of approximately 60F. These tests are valuable in determining the heating rate and the relative temperature of the water and refrigerant, but they do not simulate the normal cycle of operation.

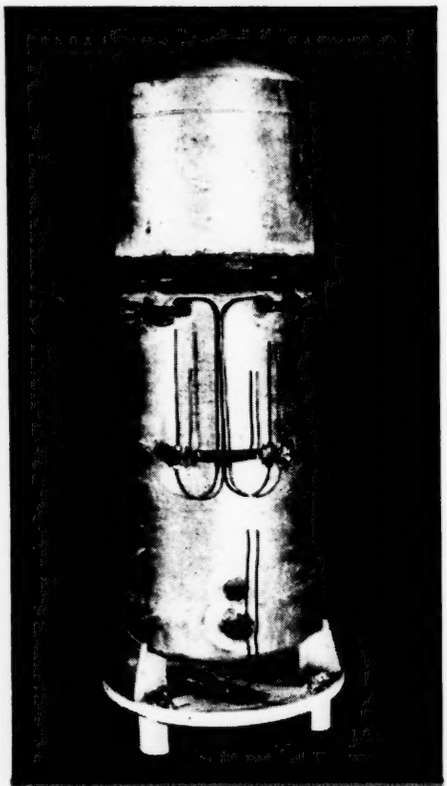


Fig. 9. Assembly for No. 4 test series without insulation or evaporator. Compressor is inside top of tank.

To more nearly duplicate the normal cycle encountered under actual field conditions, three draw-off tests were made. Test 5a consisted of drawing off 15 gallons of heated water from the top of the tank and then heating the tank water to a predetermined temperature. The makeup water to the bottom of the tank was 60F. Test 5b consisted of drawing off 25 gallons of heated water from the top of the tank and again heating the tank water to a predetermined temperature. Test 5c consisted of drawing off 30 gallons from the top of the tank and heating the tank water to a predetermined temperature.

The variations in the tank water temperature, the refrigerant condensing temperature, and the compressor watt input during these three draw-off tests are given by Fig. 11. Unfortunately the recommended draw-off tests made a part of "Test Specifications—Automatic Electric Storage Water Heater," EEI Publication No. F8 and NEMA Publication No. 103 were not followed. It is planned to make later a draw-off test in accordance with these recommendations; however, it is believed that the three draw-off tests which were made serve to indicate the performance which can be expected.

The same equipment used during test series 4b was used for these tests. The air flow over the evaporator averaged 580 cfm. The air temperature entering the evaporator averaged 69F. The evaporator air entering-leaving temperature differential was 8 to 9F, and the saturated refrigerant suction temperature was 51 to 55F. The evaporator fan motor and solenoid valve required 125 watts.

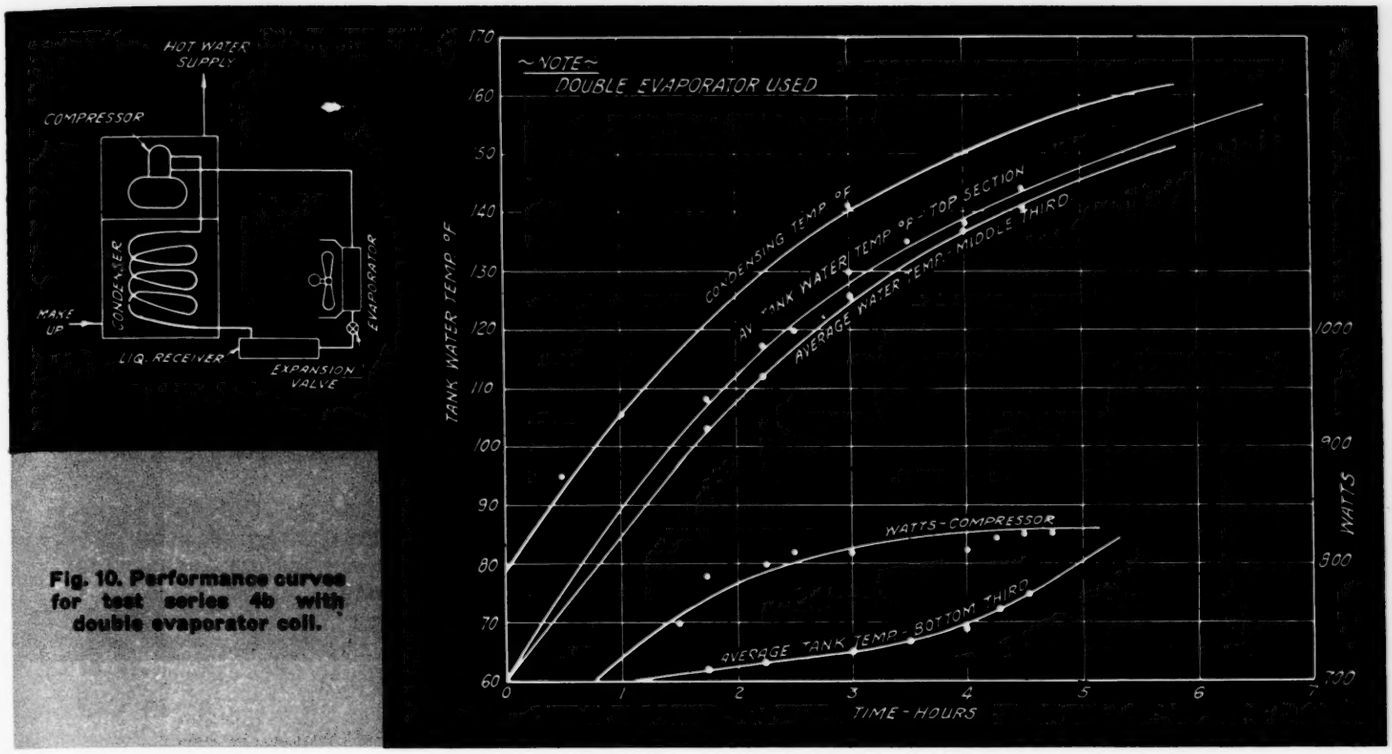


Fig. 10. Performance curves for test series 4b with double evaporator coil.

In test 5a the average final water temperature in the top section was 146F, and the average heating rate was 7600 Btu per hr. The average coefficient of performance was 2.86 for the compressor only, and 2.48 for the compressor and all auxiliaries.

In test 5b the average final water temperature in the top section was 152F, and the average heating rate was 7720 Btu per hr. The average coefficient of performance was 3.19 for the compressor only, and 2.71 for the compressor and all auxiliaries.

In test 5c the average final water temperature in the top section was 155F, and the average heating rate was 8020 Btu per hr. The average coefficient of performance was 3.31 for the compressor only, and 2.82 for the compressor and all auxiliaries.

Table 1 gives the summary results of the five test series. From an examination of this table and the performance curves given by Fig. 1, 2, 3, 6, 10, and 11, it can be seen that the coefficient of performance is materially affected by the initial tank or makeup water temperature, the final tank water temperature, the temperature of air entering the evaporator (ambient or room temperature), and the energy consumption of the auxiliary equipment. The initial and final tank water temperatures and the entering air evaporator temperature in turn determine the condensing temperature and the suction temperature. The higher the suction temperature and the lower the condensing temperature, the higher the c.o.p.

Test series No. 2 indicates that it is possible to heat 86 gallons of 60F water to approximately 130F in nine hours using a ½-hp conventional open type refrigerating

Table 1 — Summary of Test Results

Series Test Number	Reference Figure	Duration of Test, Hours	Final Water Temperature, F			Condensing Temperature, F			Suction Temperature, F			Watts Input, Compressor Motor Only			Average Heating Rate, Btu per Hr	Coefficient of Performance	
			Top Third	Middle Third	Bottom Third	Initial	Final	Average	Initial	Final	Average	Initial	Final	Average		Compressor Motor Only	Compressor Motor and All Auxiliaries
1	1	5.75	136	119	102	93	136	123.5	38	38	38	670	720	690	4630	...	2.1
2	2	9.0	133.7	131.5	129.2	72	136	102	42	48	45	690	790	740	5450	...	2.2
3	3	7.0	122	121	120	81	130	106	31	42	37	550	780	665	6100	2.68	2.4
4a	7	7.0	142	144	134	70.5	148	110	41	48.5	45	590	810	701.4	8020	3.46	2.93
4b	12	5.0	148	145	80	91	149	128	43	52	50	620	825	750	7700	2.95	2.55
5a	13	1.17	146	139	77	121	144	135	51	53	51.8	695	790	750	7600	2.86	2.48
5b	13	1.5	152	140.5	74	100	146	127	50	53	51.6	590	800	714	7720	3.19	2.71
5c	13	2.5	155	140	86	87	146	120.5	50	55	52.7	550	830	708	8020	3.31	2.82

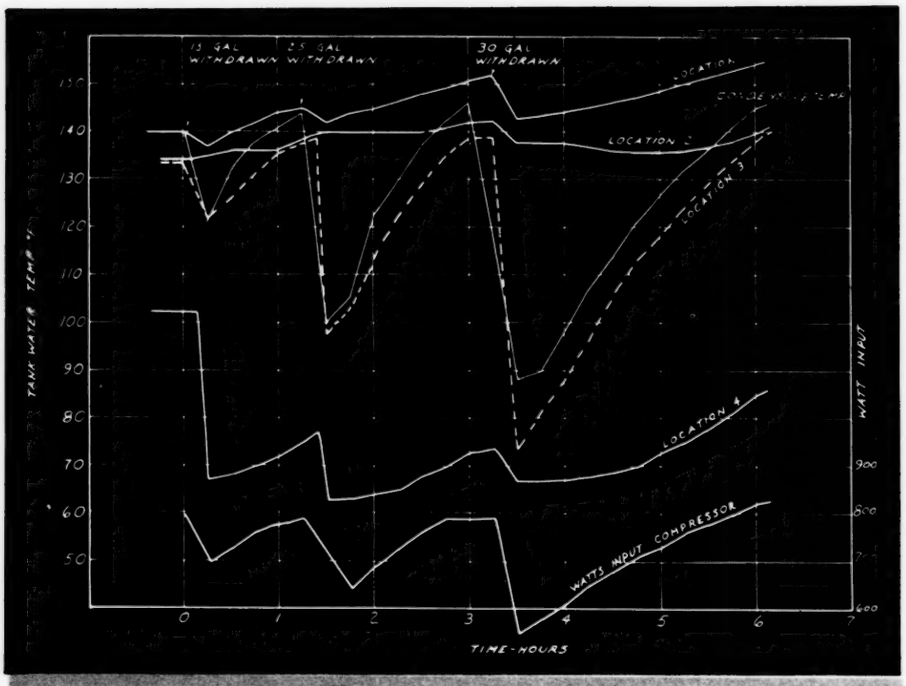


Fig. 11. Performance during draw-off tests.

compressor with all the equipment located externally to the storage tank. The average coefficient of performance which can be expected with such an arrangement will be in the neighborhood of 2.2.

As illustrated by test series No. 3, a slight improvement in performance is obtained by locating the condenser inside the water tank. In this arrangement it was possible to obtain a water heating rate of 6100 Btu per hr with a coefficient of performance of 2.4 as compared with 5450 Btu per hr with a c.o.p. of 2.2 for test series No. 2.

Test series Nos. 4 and 5 indicate that an improvement in performance is realized by locating both the compressor and the condenser in the water tank. With this arrangement it was possible to obtain an average heating rate between 7700 and 8020 Btu per hr when starting with a tank of 60F water, resulting in an average coefficient of performance of 2.55 to 2.93. In this arrangement the high temperature losses from the compressor and motor shell are utilized in such a manner to make available higher temperature water with no apparent effect on the discharge pressure of the compressor.

In the performance tests to date no special effort was made to reduce the energy consumption of the auxiliary equipment. Instead of using a forced air evaporator or cooling coil, illustrated in Fig. 9, a gravity type surface mounted externally around the storage tank is a possibility. A performance test employing such a surface is planned for the immediate future. In this way it is hoped to practically eliminate any energy-consuming auxiliary equipment and thereby obtain higher coefficients of performance. Also, the elimination of the forced air evaporator fan and fan motor would reduce first cost.

In all of the tests it was noticed that the water in the bottom 10 to 12 inches of the tank was not effectively heated. In future tests it is planned to lower the condenser in the tank which should cause all of the tank to be heated at a more uniform rate and at the same time slighly increase the c.o.p.

If final water temperatures lower than those obtained in test series No. 5 were acceptable, a much higher coefficient of performance would be obtained. For instance, if a 140F temperature in the top compartment would meet the requirement, the coefficient of performance of 3.88 would be obtained for the compressor motor only, and 3.27 for the compressor motor and auxiliaries. The higher coefficient of performance would be the value expected with the gravity type evaporator mentioned above.

The makeup water to the water storage tank was 60F for most of the tests and the air temperature to the evaporator was 70F or higher. During the winter months a lower makeup water temperature could be expected which would raise the average coefficient of performance during this period. Conversely, the entering air temperature to the evaporator would probably be lower during the winter than that used to lower the average coefficient of performance during this period.

The adverse effect produced by the low evaporator ambient temperature during the winter can be partly if not entirely offset by using the water from the drains as a heat source. The water returning from the drains is usually in the neighborhood of 75 to 95F. Before this water is allowed to go to the sewer it is passed into the water receiver where its temperature is reduced to, say, 50F. The heat removed from this water is transferred to the water tank by means of the heat pump. Taking advantage of the high temperature, waste water increases the suction pressure of the compressor, thereby increasing the overall efficiency. When the waste water is below, say, 50F, the evaporator is used for charging the water tank in which case the heat is taken from the ambient air.

To what extent this and similar arrangements can be justified to improve the coefficient of performance of a heat pump water heater will depend to a considerable extent on the type and kind of installation involved. It is given here to illustrate one of the possibilities for overcoming one of the operating difficulties facing the device.

It is the hope of the authors that the publication of these test results and conclusions will stimulate additional activities and investigations of all interested parties so that a satisfactory and acceptable heat pump water heater will be developed in the immediate future. The tests and investigations of the American Gas and Electric Company and subsidiary companies will continue and progress reports will be published from time to time. It is hoped that investigations by others will be made available to all so that development of a heat pump water heater will move forward rapidly.

Bind in

SENSIBLE HEAT LOSS IN FLUE GAS – GENERAL

A heat balance of a combustion process is occasionally desired by the heating engineer in the field; he is not as concerned with extreme accuracy as with obtaining a fair idea of where heat is being lost so that, for example, a trouble job might be corrected.

The principal stack loss is the sensible heat in the flue gas. This increases with the weight of the flue gas and the temperature of the flue gas. Each type of fuel requires a different quantity of air for theoretically perfect combustion, but the air actually furnished to the process can vary widely.

The sensible heat loss can be computed, or it can more easily be read from a chart, provided one is available for a fuel with an analysis close to that of the one in question. The accompanying charts are the first of a series covering all of the commonly used heating fuels. More of these charts for numerous fuels will appear from time to time on future data sheets.

Use of Charts. The charts show both the percentage of excess air (that supplied over and above that required for theoretically perfect combustion) and the sensible heat loss in percentage of the heating value of the fuel.

Example. A heating plant burning Pocahontas coal has a flue gas temperature of 500F and a flue gas analysis of 10.5% CO_2, 13.3% O_2, and no CO. The coal has an analysis of 83.4% carbon and 0.64% sulphur. What is the sensible heat loss up the stack, and how much excess air is being supplied?

Solution. On the chart for Pocahontas coal find, on the right-hand scale, a CO_2 of 10.5%, move left to the excess air curve, drop vertically to the horizontal scale and read 79% excess air.

From the intersection of the 10.5% CO_2 line and the excess air curve move vertically (in this case, up) to the 500F temperature line, thence left to the left scale and read 15.1% loss. Since the coal has a heat value of 14,550 Btu per lb, the sensible heat loss is .151 × 14,550 = 2197 Btu per lb of fuel.

Solution by Computation. Where charts are not available, the sensible heat in the stack gases can be computed from the formula:

$$H_s = 0.24W\,(t_s - t_a)$$

where h_s = sensible heat loss in flue gases, Btu per unit (pound, gallon, or cubic foot) of fuel,

0.24 = approximate specific heat of flue gas,

W = weight in pounds of dry flue gas per unit of fuel,

t_s = temperature of flue gas, F, and

t_a = temperature of air supplied to the process, F, usually taken at 60F.

The weight of dry flue gases (W) can be determined by detailed combustion calculations or it can be calculated if the flue gas analysis and fuel analysis are known. The following formula can be used:

$$W = \frac{11CO_2 + 8O_2 + 7(N_2 + CO)}{3\,(CO_2 + CO)} \times (C + .545S)$$

where

CO_2, O_2, N_2 CO = percent of these constituents in the dry flue gas *by volume* (from Orsat), expressed as a decimal;

C and S = percent of carbon and sulphur respectively, in the fuel by *weight*, expressed as a decimal; and

W = weight of dry flue gases in pounds per *pound* of fuel.

Example. Use the same example as previously, where there is 10.5% CO_2, 9.5% O_2, no CO, and flue gas temperature of 500F. The coal has an analysis of 83.4% carbon and 0.64% sulphur.

Solution. First determine the weight of the dry flue gases. The nitrogen content is 100—(10.5 + 9.5) = 80.0%. Then

$$W = \frac{(11 \times .105) + (8 \times .095) + 7(.80 + 0)}{3\,(.105 + 0)} \times .834 + (.545 \times .0064)$$

W = 20 lb of dry flue gas per lb of coal.

Then

$H_s = .24 \times 20\,(500 - 60)$

= 2112 Btu per lb of coal lost as sensible heat in the flue gas.

In the case of gases, care must be taken that the units of pounds and cubic feet are not confused.

Example. What would be the loss in sensible heat in the flue gases from buring a cubic foot of propane (C_3H_8) when the flue gas analysis shows 12% CO_2, no CO, 2.9% O_2, and the flue gas temperature is 600F?

Solution. The percent *C* in the gas by weight is

$$\frac{12.00 \times 3}{44.06} \times 100 = 81.71\%$$

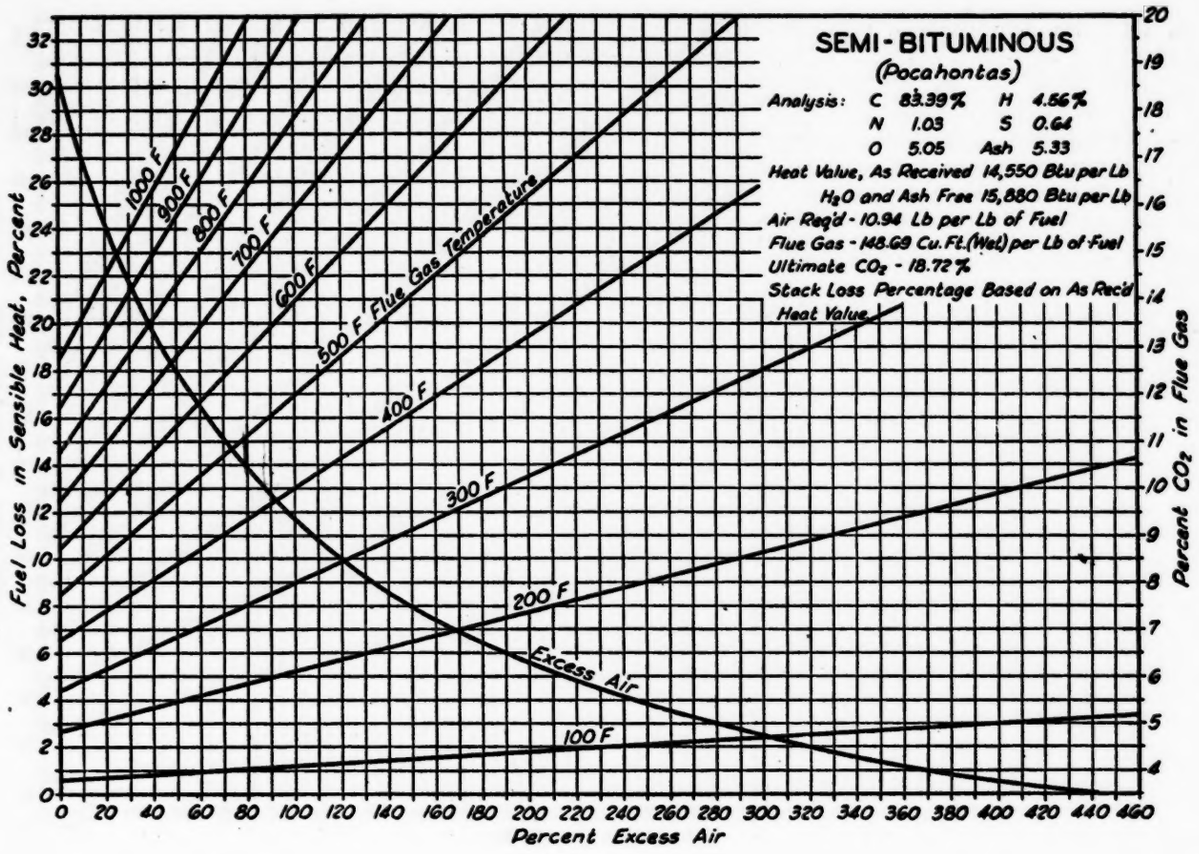
where 12.00 is the molecular weight of *C*, 44.06 that of C_3H_8, so that

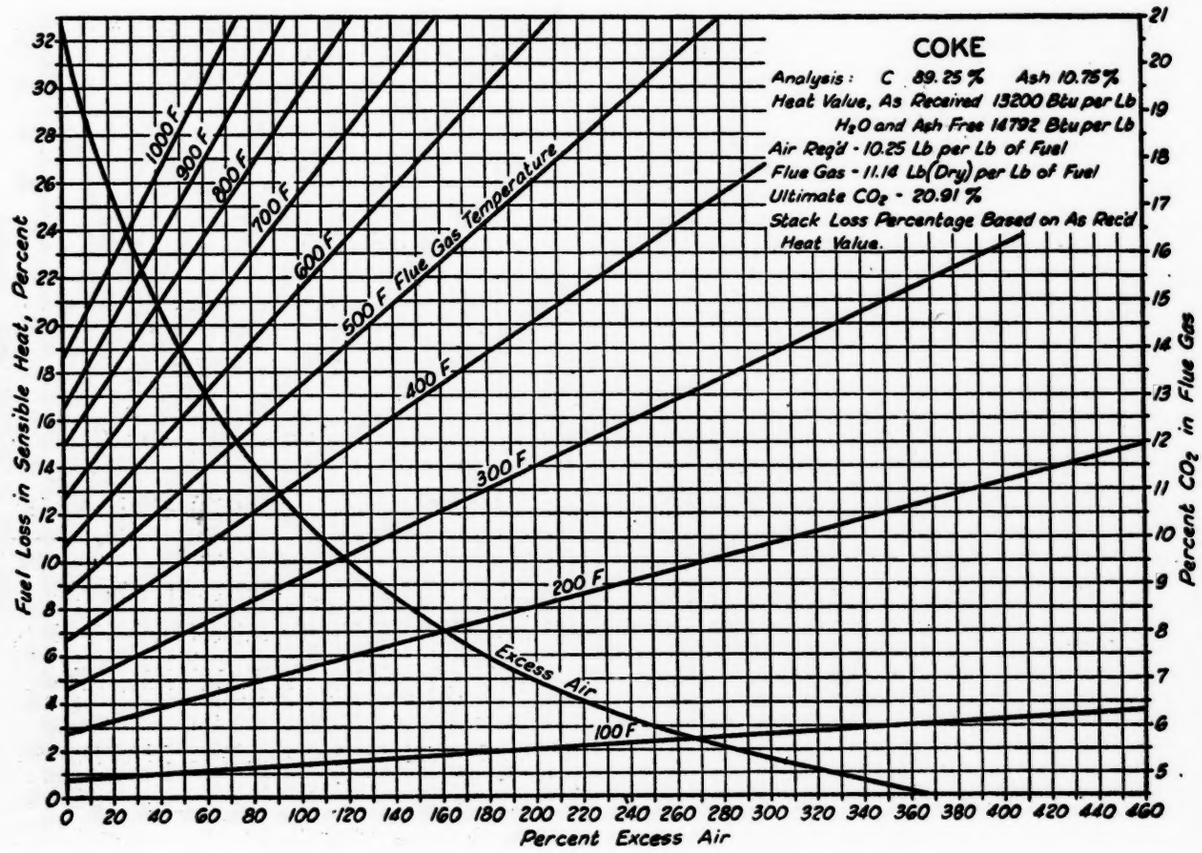
$$W = \frac{(11 \times .12) + (8 \times .029) + (7 \times .851)}{3 \times .12} \times .8171 = 17.1 \text{ lb of dry flue gas per lb of fuel.}$$

The weight of C_3H_8 per cubic foot is .1162 lb, so that the dry flue gas per cubic foot weighs .1162 × 17.1 = 1.99 lb per cu ft of propane. The sensible heat loss per cubic foot is thus

$H_s = .24 \times 1.99\,(600 - 60) = 257.9$ Btu per cu. ft.

SENSIBLE HEAT LOSS IN FLUE GAS – SEMI-BITUMINOUS AND COKE


SEMI-BITUMINOUS
(Pocahontas)
Analysis: C 83.39% H 4.56%
N 1.03 S 0.64
O 5.05 Ash 5.33
Heat Value, As Received 14,550 Btu per Lb
H2O and Ash Free 15,880 Btu per Lb
Air Req'd - 10.94 Lb per Lb of Fuel
Flue Gas - 148.69 Cu. Ft. (Wet) per Lb of Fuel
Ultimate CO2 - 18.72%
Stack Loss Percentage Based on As Rec'd Heat Value.
1000 F
900 F
800 F
700 F
600 F
500 F Flue Gas Temperature
400 F
300 F
200 F
Excess Air
100 F
Fuel Loss in Sensible Heat, Percent
Percent CO2 in Flue Gas
Percent Excess Air


COKE
Analysis: C 89.25% Ash 10.75%
Heat Value, As Received 13200 Btu per Lb
H2O and Ash Free 14792 Btu per Lb
Air Req'd - 10.25 Lb per Lb of Fuel
Flue Gas - 11.14 Lb (Dry) per Lb of Fuel
Ultimate CO2 - 20.91%
Stack Loss Percentage Based on As Rec'd Heat Value.
1000 F
900 F
800 F
700 F
600 F
500 F Flue Gas Temperature
400 F
300 F
200 F
Excess Air
100 F
Fuel Loss in Sensible Heat, Percent
Percent CO2 in Flue Gas
Percent Excess Air

Foundry Cuts its Dust Count

New shake-out and sand-handling equipment installed in foundry of Westinghouse Electric Corp., East Springfield, Mass., provide improved working conditions. Methods of heating and ventilating building are described.

SMOKY, dirty, dusty, dismal foundries have been so common in the industry that a foundry with a dust count of but 1.7 million particles per cubic foot is unusual enough to deserve more than a passing interest.

This foundry, part of the Electric Appliance Division of the Westinghouse Electric Corp., at East Springfield, Mass., produces small grey castings weighing from ½ to 40 lb each. The foundry, in a building which measures 256 ft long by 180 ft wide, produces 40,000 to 60,000 lb of castings daily and was designed for high production of highly repetitive small castings. Recently this foundry has been mechanized to eliminate as much manual labor as possible. Lifting devices and conveyors replace much of the former back-bending chores. However, the interesting features of this foundry, are the measures taken to achieve the low dust count and to make this an outstanding place for cleanliness.

After the sand passes through the perforated deck shake-out located under the foundry floor where the used sand and hot castings are separated, the sand runs over a magnetic pulley which extracts tramp iron. It then passes a vibrating screen where cores and lumps are removed. A conveyor belt carries the clean sand to a 250 ton hot sand storage bin. Two ventilated Simpson mixers mix the used sand from the storage bin with new sand, clay, and water, and discharge it to an elevator that carries it to a Royer sand conditioner. From the conditioner the sand is carried by a system of overhead belt conveyors to small sand hoppers located above each of the various molding stations.

Each molding machine operator controls the flow of sand to the mold which he is making by operating a gate on the bottom of the small storage hopper over his machine. Each molding machine is set on a subway grating over a spill sand hopper which delivers the surplus sand from the molding machine to an under-the-floor system of conveyors. The under-the-floor system consists of three rubber belt conveyors totaling 220 ft in length and six Link-Belt Company Hydraflow steel trough oscillating conveyors totaling 196 ft in length. Conveyors in this system are operated by motors ranging in size from ½ to 5 hp. Also, a part of this system are the various shake-out stations where the hot sand and hot castings are dumped onto the oscillating conveyors after the molds are poured.

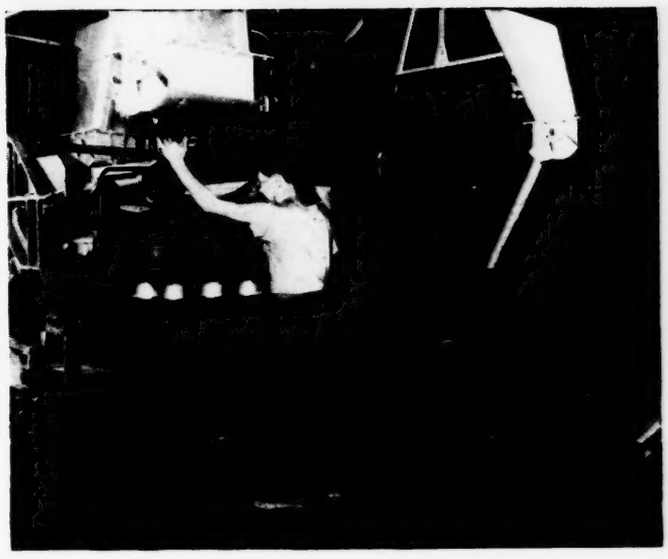
A total of 27 motors ranging in size from ½ to 50 hp are required to operate a complete sand-handling system which includes a shake-out, and sand preparation and distribution units. In addition one 50 hp and two 40 hp motors are required to handle the ventilating equipment of the sand system. Tunnels for the under-the-floor conveyors are about 8 ft deep and 8 ft wide inside. Where necessary, these are ventilated by extensions of the sand system ventilating units to remove dust and steam.

Hot castings from the perforated deck vibrating shake-out are loaded automatically onto a trolley conveyor 600 ft long which travels around the outside of the building. It delivers the castings at the entrance of the casting cleaning department at a point adjacent to the cupola charging area. The trolley conveyor trays for transporting the castings are 2 ft x 4 ft. The conveyor travels at a speed of 10 fpm. It gives the castings an opportunity to cool down as they travel around the outside of the building. This keeps heat out of the building during warm weather and also conveys the castings to the next manufacturing operation.

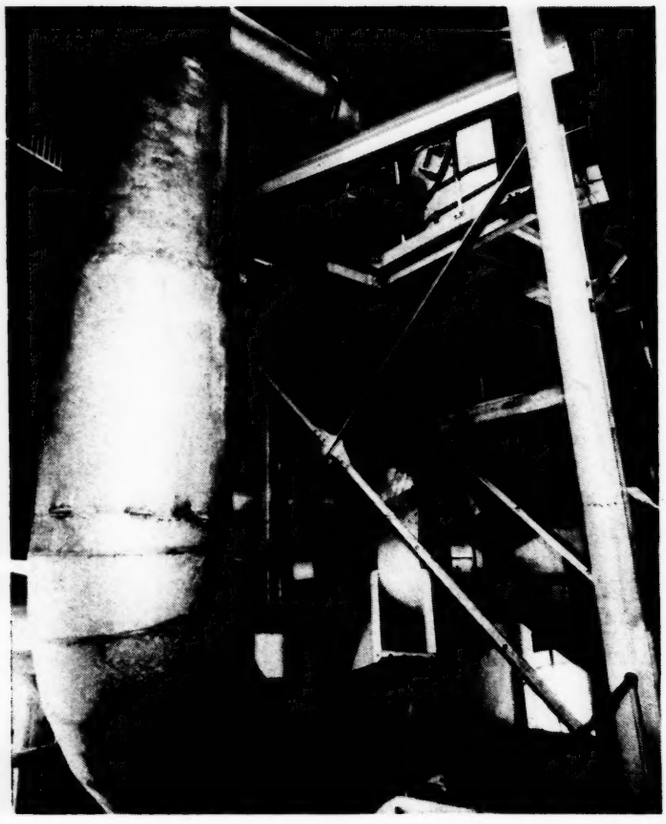
Heating the Foundry

The foundry is heated by unit heaters, heat curtains, and steam coils.

The general open area used for molding, pouring, and cleaning operations is heated by 8 unit heaters suspended under the roof of the building along the inside building column lines where the heaters offer a minimum of interference to crane equipment and light from overhead windows. Air inlets are equipped with dampers to allow air to be drawn from within the building or from the outside through roof inlets. During shut-down periods, such as weekends, inside air is recirculated. During working periods outside air or a mixture of outside and inside air is used as desired. With steam shut off and outside air inlets



Filling the drag with sand from an overhead sand hopper. Note the subway grating through which the excess sand is discharged to an under-the-floor sand collecting system.



Two of the exhaust fans that are part of the ventilating system for the foundry.

open, these units serve as cooling fans during the summer weather. Each heater is provided with three fans and three outlets which are louvered to give uniform distribution of the exit air. Using 5 lb steam pressure and zero degree inlet air, these heaters each have a capacity of 1,400,000 Btu.

Eight small unit heaters are located along the window areas of outside walls to provide heat in restricted locations. With 5 lb steam pressure, these heaters each provide about 80,000 Btu with 60F entering air.

Steam coils are provided along the outside window areas at several points where operations are performed close to the windows and where a draft from a unit heater would be objectionable.

All of the unit heaters are individually controlled by nearby thermostats.

Curtain Heaters

Forced air curtain heaters are placed over most outside doorways and the entrance and exit of the trolley conveyor to prevent the entrance of cold outside air during winter weather. Ten curtain heaters are installed of Sturtevant, Trane and Carrier makes with a total capacity of 4,500,000 Btu. The combined unit and curtain heaters require a total of 48 hp for their operation and are capable of maintaining a temperture of 60F inside the building when an outside temperature of zero prevails and the wind has a velocity of 15 mph.

An additional heating unit is now being installed to provide a flow of fresh air progressively over the molding, pouring, and shake-out areas. The unit will draw outside air through a roof opening and will provide 15,100 cfm of air. Heating capacity is provided to heat the intake air to 88F with outside temperatures as low as 10F. Steam at 10 lb pressure will provide 1,600,000 Btu. A 5 hp motor will operate the unit.

Roof ventilation is supplied by 18 H. H. Robertson Company fan-driven propeller type roof ventilators which furnish a capacity of 113,000 cfm. They require a total of 10 hp to operate. These fans, together with the air removed by the dust collectors, account for the withdrawal of 206,000 cfm or sufficient air to provide 8.4 complete changes of air in the foundry every hour.

Three bag type, dry dust collectors draw air from dust producing machines, such as tumblers, Wheelabrators, grinders, and sand blasters. These collectors (two American Foundry Equipment Co., and one Pangborn Corp., with a total capacity of 33,000 cfm) extract about one cubic yard or 2,430 pounds of dust each day.

In addition, installed in the foundry are three American Air Filter Roto-Clone wet dust collectors with a total capacity of 60,000 cfm. These filters draw air from dust producing areas of the sand system, such as shake-outs, tunnels, and vibrating screens where steam is mixed with dust. Two of these units discharge the dust collected into the sewage system along with the waste water. The third unit is equipped with a settling tank which collects the dust as a sludge. The amount of sludge collected each day is approximately one cubic yard or 1,350 lb.

Reduction in Dust Count

Before the installation of the new shake-out equipment when the molds were dumped by hand, the dust counts varied between 3 and 35-million particles per cubic foot of air with an average value of about 20-million. Since the new system of handling the shake-outs was installed, the dust count has been reduced to 1.7-million particles per cubic foot, whereas formerly, the general foundry air carried 1 to 5-million dust particles per cubic foot of air. At present, this has been reduced to roughly 1.5-million. Although the dust count around the molding machines was never high, because the molding sand is moist, it is now about 0.8-million particles per cubic foot.

It is interesting to compare these figures with the recommendations of the Massachusetts Department of Labor and Industry Division of Occupational Hygiene which states that the average exposure in foundries be kept below 25-million particles per cubic foot.

The noteworthy features of this foundry at East Springfield can be better apprcciated when note is made of a recent statement by B. F. Postman, industrial hygiene engineer. He wrcte, (HEATING AND VENTILATING, December, 1948, p 65) "Foundry operating procedures today are little different from what they were 25 years ago, except possibly for casting size, improved production methods, and partial or complete mechanization. The existing ills of poor working conditions are not peculiar to any type or size of foundry."

What Happened at Chicago

• 55th Annual Meeting, American Society of Heating and Ventilating Engineers
• 9th International Heating and Ventilating Exposition

A summary of the papers presented at the 55th annual meeting of the American Society of Heating and Ventilating Engineers held at Chicago, January 24 to 27, 1949 is presented on the following pages.

OVER 2,500 people, including 1,300 members, registered for the 55th annual meeting of the American Society of Heating and Ventilating Engineers at the Hotel Stevens in Chicago, January 24 to 27. Registration was also exceedingly heavy at the 9th International Heating and Ventilating Exposition held concurrently at the International Amphitheater.

Presiding at business and technical sessions were G. L. Tuve, ASHVE president, A. E. Stacey, Jr., first vice president, and Lester T. Avery, second vice president. Speaker at the welcome luncheon was Dr. Henry T. Heald with C. M. Burnam, Jr., president of the Illinois chapter, presiding. The Illinois chapter was host to the national organization during its stay in Chicago. At a luncheon meeting on January 25, members heard a talk by Cyril Tasker, ASHVE Director of Research. Mr. Tasker was introduced by L. M. Hunter, chairman of the Committee on Research. At the annual banquet, toastmaster John Howatt, ASHVE past president, introduced Dr. Clark G. Kuebler, president of Ripon College, who spoke on the subject, "Formula For Freedom."

Inspection trips included conducted tours of the Ilg Electric Ventilating Co. plant, the merchandise testing and development laboratories of Sears, Roebuck & Co., and the plant and laboratory of McDonnell & Miller, Inc. Special events were planned for the ladies and included a style show, radio program, etc.

Officers elected at the Chicago meeting are shown below.

Following are brief abstracts of papers presented at the technical sessions.

Packed Cooling Tower

Three groups of tests were made in a large forced draft tower constructed at the University of California to obtain performance and other data. Results of these tests and studies are summarized in a paper on "The Internal Performance of an Induced Draft, Packed Cooling Tower," by N. W. Snyder, assistant professor of mechanical engineering, University of California. It was found that:

1. Air enthalpies decreased sharply with water rates at all positions in the packed section for values of (water rates, pounds per hour) (air rate, pounds per hour) from 0.35 to 0.4, indicating a possible critical point for partially wetted packing.

2. The water temperatures over any cross section in the packed section were maximum approximately midway between the tower sides. Values were found to be from 5 to 20 deg. higher than those near the sides.

3. The temperature of the water film on the walls was found to decrease by only 40% of the decrease in temperature of the packing water over the height of the packed section.

4. The total water flowing was found to be divided as follows: wall water film, 40%; water drops between packing slats, 30%; water film on packing, 30%.

Newly-elected officers of the ASHVE are, from left to right: president, A. E. Stacey, Jr., Carrier Corp.; first vice president, Lester T. Avery, Avery Engineering Co.; second vice president, Lauren E. Seeley, Dean, College of Technology, University of New Hampshire; treasurer, Ernest Szekely, Bayley Blower Co.

5. The point enthalpy transfer coefficients per unit volume, were maximum approximately halfway between the ends of the packed section.

6. Overall enthalpy transfer coefficients per unit volume of the spray section above the packing were from 185 to 235% greater than for those in the packed section. Overall enthalpy transfer coefficients per unit volume were found to vary from 85 to 360 Btu per (hr) (cu ft) (Btu per lb dry air) for the sprays and 40 to 160 Btu per (hr) (cu ft) (Btu per lb dry air) for the packing over a water rate range of 6,500 to 95,500 lb per hr. Air rates remained approximately 67,000 lb per hr $\pm$ 19% for all runs.

7. For the range of water flow of 6,500 to 95,500 lb per hr and an average air rate of 67,000 lb per hr, the pressure drops varied from 0.2 to 0.35 in. of water, respectively. Correspondingly, the computed Fanning friction factors were found to vary from 0.40 to 0.70. The Reynolds Number for air was approximately 50,000 based upon an hydraulic radius of the net cross-sectional area.

Time Response in Floor Panels

Due to the increasing number of homes being constructed with floor panel systems, a study of the automatic control of such systems to obtain comfort conditions was made in an experimental house by A. B. Algren, professor of heating, ventilating and air conditioning at the University of Minnesota, and Ben Ciscel, control system analyst, Research Division, Minneapolis-Honeywell Regulator Co. Results of this research are given in their paper, "Heating Panel Time Response Study."

In this study a system of wire thermocouples was used and more than 100 points of temperature measurement were established. The mean radiant temperatures were determined by 12 thermocouples taped to each wall, floor and ceiling. Since a primary factor in house temperature is the time lag of the heating panel, transient conditions were established. The heating panel was a 4 in. concrete slab laid on 9 in. of crushed rock.

As a result of this extensive study, the following interesting conclusions were established.

1. The mean radiant temperature was generally within a degree of the room air temperature.

2. Maximum air temperature rise rates were about 8F per hour and usually occurred about an hour after the heat input had been increased. Floor coverings or a smaller heat-input to the panel would further delay the rise of room air temperatures.

3. Heating plants for floor-panel heated houses should be capable of supplying heat well above the expected demand in order to take care of transient heat storage and losses.

4. Measurements taken before and after these periods of transient conditions show that steady state losses were within reasonable limits as contrasted with the excessive heat inputs required during heating up periods.

5. The air temperature was higher than the wall and ceiling temperatures. This indicated some heat transfer to these surfaces by convection and conduction as well as radiation.

6. The transient conditions in these tests were much larger than those which would be encountered in normal control operations, but the time lags involved should be independent of the temperature variation range.

Balancing Air Delivery

George S. Dauphinee and Peter Argentieri, respectively, design and development engineer, and design engineer, W. B. Connor Engineering Corp., in their paper "Balancing Air Delivery of a System of Manifold Air Diffusers" presented a means for balancing air diffusers in a ventilating system. While the authors presented several examples to clarify theory and application, results depend upon the use of dampers in the outlet, so calibrated that one can obtain any desired percentage of the full-open outlet capacity.

A duct system so designed that it would discharge the required air volume from respective outlets without the aid of dampers would not be practicable. However, unless such dampers are calibrated to produce a known result directly, an unavoidable amount of trial and error procedure will result before the system is balanced. The paper is based on the use of dampers which are part of the outlet and have a known effect on outlet performance.

The balancing method described depends on two steps performed in the following sequence. (1) All dampers should be fully opened and capacity readings taken for each outlet while the fan volume is held constant. (2) A calculation is made to determine the ratio of actual air delivery of each diffuser to the actual air delivery from all the diffusers. From this ratio can be calculated the percentage of damper opening required for each diffuser. A check is then made by actual operation, after dampers have been set, to see if the air delivery is in accordance with that specified for the respective diffuser. By adjusting the fan speed to produce the delivery required for any one outlet, all other diffusers will deliver their respective specified amounts.

Most of the operations are slide rule computations. However, the manual part consists of (1) opening all dampers, (2) determining air delivery from each diffuser, 3) setting dampers, and (4) checking the output of several outlets.

Estimating Air Conditioning Loads

Although there are many methods of estimating summer air conditioning load and making equipment selection, the points in which there are some differences are in the directness of approach and the assurance of results. A method used for 15 years by C. M. Ashley, chief development engineer, Carrier Corp., is described in his paper, "Psychrometric Factors in the Air Conditioning Estimate."

In the method for making a cooling load estimate in accordance with the method advocated by Mr. Ashley, the steps may be grouped under six heads:

1. Pre-selection of the outside and room conditions.

2. Calculation of the ventilation requirements in terms of air quantity.

3. Determination of the by-pass outside air load using the coil by-pass factor determined from the preselected coil depth and face velocity. This factor is a term for expressing coil performance in relation to the room air condition and the apparatus dew point.

4. Determination of the sensible heat factor and from this the coil apparatus dew point.

5. Calculation of the dehumidified air quantity based upon the room conditions, the coil apparatus dew point and the coil by-pass factor.

6. Selection of the equipment as determined by the grand total heat and the refrigerant temperature.

To show how this system compares with some of the others now being used, a tabulation was made to show the points of differentiation. The methods listed use some equivalent of the sensible heat factor for determining the state point of the air leaving the apparatus. The principle of the coil apparatus dew point and the by-pass factor are also recognized by some of the systems listed. The main differences occur in the determination of the amount of dehumidified air and the selection of the cooling coil.

The table makes a forceful presentation of the salient differences between the Ashley method and other possible means of handling the problem of air conditioning estimate.

Heat Transfer Rates for Freon

In spite of the general use of dichlorodifluoromethane (Freon-12) as a refrigerant in direct expansion heat exchangers, little basic information is at hand regarding its heat transfer behavior. Generally, it has been assumed that evaporating Freon has some average heat transfer coefficient and then this coefficient has been applied to heat transfer equipment to obtain performance data. This has sometimes resulted in erratic performance data and in some cases may actually lead to the selection of improper equipment for a given service.

This being the case, three investigators from Case Institute of Technology conducted some experimental work, the object of which was to examine and to correlate the factors which seem to have the most significant effect on heat transfer such as loading, oil circulation with the Freon, ratio of length to diameter, refrigerant flow, and temperature difference, tube to refrigerant.

The investigators were L. G. Seigel, W. L. Bryan, and M. C. Huppert, associate professor, assistant professor, and graduate student, respectively, at Case, and their paper was entitled "Heat Transfer Rates for Refrigerant Boiling in Horizontal Tube Evaporators." The tests were run on $\frac{5}{8}$ in. tubing and the investigators concluded that the heat transfer rate for Freon-12 evaporating in horizontal tubes may be correlated in terms of heat transfer in Btu per hour per square foot of surface per degree F, temperature difference vs. temperature difference, but suggest that additional tests should be run with different tubing diameters. They also found that the presence of oil in Freon-12 evaporators does not seem detrimental to heat transfer when the oil is present in quantities such as obtained with ordinary commercial equipment. However, quantitative tests should be run to determine how much oil can be tolerated before the heat transfer is affected.

The authors concluded that ratios of heated length of tube to inside diameter from 123 to 432 had no effect on heat transfer. However, only one tube diameter was used in this investigation and, therefore, similar data should be obtained for other diameters.

Baseboard Radiators

Additional tests on radiant baseboards, conducted at the University of Illinois during 1948, were reported by R. H. Weigel and W. S. Harris, special research assistant and special research professor at Illinois, in a paper "Heating a Basementless House with Radiant Baseboard." The tests reported on were part of a cooperative research program between the University and the Institute of Boiler and Radiator Manufacturers.

The object of the tests was to determine the operating characteristics of a hot water heating system using cast iron, radiant baseboards in a basementless home. These characteristics included the temperature of the floor slab, the temperature gradients in the rooms, the operating temperatures in the hot water system, fuel consumption, relative humidity, and cleanliness of operation.

A summary of the test results of this investigation and the conclusions that may be drawn are as follows:

1. The radiant baseboard is particularly adapted to maintaining comfortable floor slab temperatures in a basementless structure, as long, low units of this type cover a large percentage of outside exposure.

2. Average air temperatures, as measured three inches above the floor, were approximately 70 to 71F for all indoor-outdoor temperature differences encountered when the temperature at the 30-in. level was 72F.

3. Temperature differences between the occupancy zone, as measured 3 in. and 30 in. above the floor, were only of the magnitude of a degree and a half to two degrees.

4. The hot water heating system using the radiant baseboard responded quickly to sudden changes in load, thus maintaining constant room air temperature even while the outdoor temperature was changing rapidly.

5. The problem of maintaining adequate indoor humidities for comfort in winter cannot be separated from consideration of good building construction. At 10F outdoor temperature 22% relative humidity was obtained in the basementless home.

6. Fuel consumption was not affected by setting of the adjustable differential on the thermostat; however, water temperatures in the radiant baseboards, and consequent fluctuations in room air temperatures, were affected. The longer lengths of the on and off periods of the burner and circulator resulted in greater fluctuations of room air temperatures.

7. Faint dirt patterns were observed on some of the walls above the radiant baseboard after nine months of operation. Dirt patterns of this type can be eliminated by limiting the water temperature to a maximum of 200F.

Air Distribution and Draft

In a paper "Air Distribution and Draft," John Rydberg and Per Norback, professor of heating and ventilating and research engineer, respectively, of the Royal Institute of Technology, University of Stockholm, went into the theory of air flow and temperature distribution in jets. They found that a whole group of discharge devices, for practical purposes, may be satisfactorily computed in advance, both as regards the course of jet and the risk of draft; these are the cases where the air is discharged through concentrated outlets, such as circular or rectangular holes or grids of various designs. The detailed shape of the hole or grid need not be known; the only condition is that the jet be not disturbed by surrounding walls, that the ratio between the longest and shortest side is not too great, and that no guide vanes are employed to give the air a special direction.

Basic equations were given for computing the velocity and angle of various jets, for computing air discharge from grids, temperature distribution in air jets, effective temperature in an air jet, and minimum draft for cold air discharge.

Chimneys

Two papers on house chimneys were presented, one on "Performance of Fourteen Masonry Chimneys Under Steady State Conditions," by two National Bureau of Standards engineers, another by two Battelle Memorial Institute men on "Performance of Residential Chimneys." The Bureau of Standards paper was by Paul R. Achenbach, assistant chief, heating and air conditioning section, and Selden D. Cole, mechanical engineer of the same section. The Battelle paper, conducted for Bituminous Coal Research, Inc., was prepared by L. B. Schmitt and R. B. Engdahl, research engineer and supervisor, respectively, of the Institute.

The object of the Bureau of Standards paper was:

1. Measurement of the draft produced by chimneys made of the various materials under steady state conditions for a range of mass flows of the flue gases and for a range of temperatures.

2. Comparison of the draft produced by metal-lined chimneys and refractory-lined chimneys.

3. Comparison of the performance of round and rectangular flue liners of equal cross-sectional area and of round and square flue liners of equal principal dimensions.

4. Measurement of the effect on the draft produced when one of two contiguous liners in the same chimney carried hot gases while the other was open.

5. Observation of the effect on the draft produced when the base of a chimney was sealed at the bottom of the thimble.

6. Determination of the effect of grouting in the liner with mortar on the available draft.

Results of the tests were summarized as follows:

1. Lined masonry chimney built of shale-tile or cinder-concrete blocks are the equivalent of lined brick chimneys in draft-producing ability and effectiveness.

2. A chimney with an enameled steel lining surrounded by 1 in. of granular insulating material produced slightly more than a refractory-lined chimney of the same internal diameter at low rates of gas flow (20 cfm) but no appreciable difference was apparent at higher gas-flow rates. The chimney friction was practically the same for the 7-in. diameter metal lining and the 7-in. diameter refractory lining when both were clean.

3. A 7-in. round flue lining is not the equivalent of a 7- by 7-in. square lining in capacity. The available draft increased successively in the 7- by 7-in. liners as the gas-flow rate was increased from 20 to 70 cfm, whereas it increased slightly in the 7-in. round liner for increasing flow from 20 to 45 cfm and decreased between 45 and 70 cfm. The friction loss was measurably greater in the 7-in. round flue linings at a gas-flow rate of 70 cfm than in the square liners.

4. A 10-in. diameter flue liner and a 7- by 11-in. rectangular liner having equal internal area produced about the same available draft, had about the same loss of draft due to friction, and had equal effectiveness under comparable conditions.

5. In a chimney containing two contiguous liners, one liner operating alone while the other was open at the bottom produced from 10 to 15% less draft than a chimney containing only one liner of the same size. When both liners received flue gases at the same temperature each produced a draft nearly equal to that produced by a chimney with only one liner.

6. Sealing off the air space in the base of a new well-constructed chimney at the bottom of the thimble had no important effect on the draft produced.

7. Grouting in the liner of a masonry chimney with mortar did not decrease the average flue-gas temperature in the chimney or the available draft produced.

8. Although information was obtained on the several specimens for only one chimney height, the results observed for chimneys made of shale-tile and cinder-concrete block were so nearly equivalent to those obtained for brick chimneys that the results for brick chimneys may be safely used for all practical applications.

The Battelle paper was the result of an attempt to obtain practical information on the performance of residential chimneys. The authors reported that:

The quickest and most reliable means for obtaining information on a chimney is through experimental measurement, inasmuch as the large number of variables affecting the operation of a chimney make precise chimney analysis not only extremely difficult but also limited in its application.

Tests were conducted on four different types of chimneys to obtain their operational characteristics. Two of the chimneys were common brick, one was constructed of light-weight materials, and one was an experimental double-walled chimney designed to overcome the effects of wind.

It was found that chimney efficiency varied only slightly with the various chimneys tested, and was not greatly affected by the materials or type of construction. The cross-sectional area did have some effect on the efficiency, but only insofar as it affected the friction and the recirculation losses.

Recirculation of the flue gases within the chimney and flue pipe was found to have considerable effect on the cooling and the friction losses. The effect of recirculation decreased as the rate of flow increased.

When the flow of gases was increased beyond approximately 200 lb per hr, to simulate chimney operation with stoker equipment, the draft and efficiency were found to decrease, the rate of decrease depending upon the inlet temperature. This effect was expected, since friction losses increase as the square of the rate of flow.

Tests were conducted under simulated wind conditions on the experimental double-walled chimney, and also on a commercial chimney top. Wind was found to have undesirable effects on both the double-walled chimney and the chimney ventilator. It is recognized that wind may have a deleterious effect on the operation of a short chimney because of the low available draft often provided by this type of chimney.

A method was described whereby the available chimney draft for the small residential chimney can easily be calculated within an accuracy of $\pm 10\%$.

Gas Conversion Burners

Automatic air shutters have generally been supplied as standard equipment on conversion-type gas burners for the purpose of saving fuel by preventing circulation of air through the boiler or furnace when the gas valve is closed.

William M. Myler, Jr., and Harlan W. Nelson, ran tests at Battelle Memorial Institute to determine the value of automatic air shutters under operating conditions simulating those obtained in a home installation. Their paper reporting results was entitled "Are Automatic Air Shutters Justified on a Gas-Fired Conversion Burner?"

The authors, chief engineer, Janitrol division, Surface Combustion Corporation, and Supervisor, Battelle, respectively, concluded as a result of the tests that at least for a burner having a small mass of material in the combustion space, the saving in fuel is too small to justify the cost of adding the automatic air shutters to a conversion burner.

Temperature Change and the Human Heart

There is little difference in the way persons with heart disease and those with normal hearts react to sudden changes in temperature, according to a six-man study reported in a paper entitled "Physiologic Adjustments of Normal Subjects and Cardiac Patients to Sudden Change in Environment." The authors said that this finding was "in accord with general experience of the public that no ill effects are apparent to normal individuals making the adjustment required by entering and leaving an air conditioned space during the hot summer months."

The physiological adjustments of ten healthy, male medical students and 16 cardiac patients were compared on exposure to sudden change in environmental temperature. The research was sponsored by the ASHVE in cooperation with the University of Illinois, College of Medicine. The medical students ranged in age from 19 to 29 years, the cardiac patients were from 25 to 72 years old.

The results of the research indicated "that the observed responses of cardiac patients on exposure to sudden changes in environmental temperature were similar in most respect to those of young normal subjects. The few definite differences that did appear may represent differences which would have been observed as a result of the aging process in relatively normal individuals."

The experiment was conducted by five members of the University of Illinois Department of Medicine: Dr. Robert W. Keeton, department head; Nathaniel Glickman, assistant professor of medicine and research physiologist; Tohru Inouye, research assistant; Dr. Irwin R. Callen, instructor in medicine; Dr. Ford K. Hick, associate professor of medicine, and Maurice K. Fahnestock, assistant director, Engineering Experiment Station, department of mechanical engineering.

The test subjects (dressed in thermocouple union suits) remained in a comfortable room for one hour and then entered a hot room for one hour after which they returned to the comfortable room for one hour.

Observations taken included skin and rectal temperatures, evaporative weight loss, time of onset of perspiration, blood pressure, pulse rate and subjective sensation of warmth or coolness. The scale for the subjective sensation of comfort was: 1-cold, 2-cool, 3-slightly cool, 4-comfortable, 5-slightly warm, 6-warm, 7-hot. The subjects were trained in the use of the comfort scale before starting the experiment.

The comfortable room was maintained at a constant dry-bulb temperature of 76F and a water vapor pressure of 0.356 psi corresponding to a relative humidity of 80% and an effective temperature of 73.4. The hot room was maintained at a dry-bulb temperature of 98.5F and a water vapor pressure of 0.599 psi corresponding to a relative humidity of 66% and an effective temperature of 90.2.

The authors reported that "there appeared to be no greater stress on the cardiovascular system of the cardiac patients than that of the normal subjects as measured by changes in the pulse rate. The cardiac patients had less of an increase in pulse rate on entering the hot room, less of an overall increase during the hot room exposure and less of a decrease on re-entering the comfortable room."

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In comparing the skin temperatures of various segments of the body for both groups, only the temperature of the foot was found to be significantly different.

The lower temperature of the foot for the cardiac group "probably represents vascular changes incident to their disease and their age," the authors reported.

Value of *U* for Glass

"Overall Coefficients for Flat Glass Determined Under Natural Weather Conditions" was the title of a paper by George V. Parmelee and Warren W. Aubele, research associate and assistant research engineer, respectively, ASHVE Research Laboratory. The authors reported on a limited study of overall heat transfer coefficients for glass under natural weather conditions.

Results of the study are summarized as:

1. Tests for heat loss through single and two air-spaced sheets of flat glass show that radiation exchange between the glass on one hand and the ground surroundings and the atmosphere on the other plays a significant part in heat loss from outdoor surfaces. Because of the limited range of conditions under which these tests were made with regard to wind velocity and clearness of the atmosphere, further investigation is suggested.

2. The uncertainty connected with computing the radiation exchange and the convection loss due to turbulent wind conditions at an outdoor surface indicates the need for improved instrumentation. It is apparent that an instrument is needed which is capable of determining the magnitude of the net low temperature radiant energy exchange between a surface at the earth and the atmosphere. This instrument should be adaptable for both nocturnal and daylight conditions.

3. It has been demonstrated that the *U* value concept as used in estimating building heat losses or gains does not satisfactorily take into account many common radiation exchange conditions. The significant effect of indoor conditions on heat transfer to a window suggests the need for field studies of heat loss through such openings under different surroundings.

4. Although the conditions which governed heat loss in the calorimeter tests do not necessarily duplicate the conditions to be found in practical situations, the results indicate that for many cases the currently used *U* value of 1.13 for single glass is a good approximation but that the value of 0.45 for double-glazed windows is from 25 to 45% too low for design wind velocities. This statement does not take into account the influence of sash members. In other words, for double-glazed windows *U* should be 0.60 to 0.65 for ¼-in. air spaces and 0.55 to 0.60 for ½-in. or wider.

Insulation of a House

Seeking actual performance data on the economic and comfort advantages of house insulation, R. J. Lorenzi and J. F. Schreiber conducted tests on a full-scale experimental house. The authors, research engineer of the John B. Pierce Foundation and development engineer, United States Rubber Co., respectively, titled their paper on these tests "Performance of an Electrical System of Panel Heating with Four Stages of Insulation," the heating being by panels of electrically conductive rubber. The test house was occupied by an elderly couple and their daughter.

The data were reported in terms of a "heat factor" —the kilowatt-hours consumed per degree-day per 1000 cu ft of space. The house was tested first under original conditions—with insulated walls only. Step 2 involved installing double windows, Step 3 insulating the ceiling and Step 4 insulation of the floor. Savings were as follows:

After Installation of	Cost	Saving per Year During Amortization	Saving per Year After Amortization
Double Windows	$183	$120	$135
Ceiling Insulation	255	140	160
Floor Insulation	341	157	184

The foregoing table was based on actual results at a 2 cent per kilowatt-hour rate prevailing for Raritan, N. J., where the test house is located. These data were extrapolated for electric rates of 1 cent and ½ cent as follows, covering the cost of heat loss per season:

After Installation of	2 cent rate	1 cent rate	½ cent rate
Original house	$531	$277	$151
After double windows	396	210	117
After ceiling insulating	370	197	111
After floor insulating	347	185	105

Comfort observations are as follows:

During the entire heating season operation continued without difficulty, both panels and controls functioning properly. Good response to the on-off type room thermostat was due to the minimal heat capacity and low thermal lag of the heating panels. This made it possible to control the panel heating system without an outdoor thermostat. In general, the occupants reported comfort during the test periods in each insulation step with the exception of Step 1 in which no storm sash was used. An unsolicited statement by the occupant indicated considerable improvement in comfort by the addition of the storm sash. Comments on cold floor conditions in some rooms (which was expected due to the unusual floor construction of the test house) resulted in the addition of the under-floor insulation in Step 4 and showed the necessity of the insulation for this type of construction.

Turbulence in Air Distribution

The effects of turbulence in air distribution were analyzed as quantitative factors in engineering procedure in a paper entitled "Turbulence—a Fundamental Frontier In Air Distribution," by H. S. Nottage, research associate at the ASHVE Research Laboratory. While understanding of the exact mechanism of turbulence is still incomplete, the paper analyzed available empirical methods and described experimental work in support of recommended procedures.

Joints to Permit Movement

J. E. YORK

Building Service Engineer, Stone & Webster Engineering Corp.

Part 2 of a three-part article covering the type joints available to compensate for expansion or contraction of a pipe line. This section deals with rubber expansion joints and spool type joints.

A CONTROLLED or directed flexing, self-equalizing expansion joint with flanged ends is shown in Fig. 16*a*. These units are available with stainless steel or copper corrugations with or without stainless steel or monel internal sleeves. The control rings are made up in two half-round sections per ring, firmly anchored into the corrugations to close working dimension tolerances: The relationship between the corrugations and the control rings when the line is cold is shown in Fig. 16*b* and when the line is hot in Fig. 16*c*. The units are furnished in suitable lengths for traverses up to 6 in. Traverse is recommended in compression only. For special installations where motion in extension of the expansion joint is required, it may be installed in the compressed position equal to the extension required after installation.

The satisfactory operation of the expansion joints in a piping system is dependent not only on the selection of the proper joints to provide for changes in length duc to expansion and contraction, but also on the selection and installation of the necessary anchors of suitable design and at suitable locations to provide proper alignment and secure anchorage of the pipe with free movement of the joint.

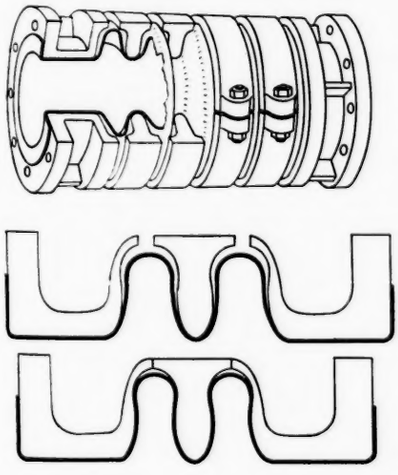


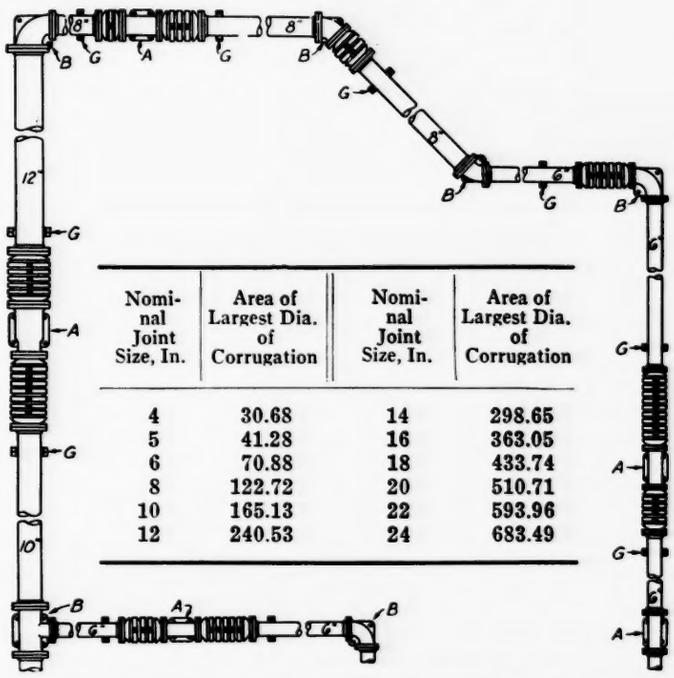
Fig. 16a, upper. Self-equalizing expansion joint with flanged ends. Fig. 16b, center, and Fig. 16c, lower, show, respectively, the relationship between corrugations and control rings when line is cold and hot.

The procedure for the selection of self-equalizing directed flexing expansion joints and anchors for the steel pipe line shown in Fig. 17, which is subjected to a maximum temperature of 340F and 100 lb pressure with the line installed at 60F, is as follows:

Main anchors marked *B* should be provided at all apparatus, end of line, or where changes in direction of line occur. These should be designed to withstand the whole line thrust due to pressure within the line plus the force needed to collapse the expansion joint.

Intermediate anchors should be provided at all points marked *A* where it is necessary to fix one end of the expansion joint and there is no change in direction of the pipe line. These should be designed to withstand the force to collapse the expansion joint.

Guides designed to keep the pipe in alignment should be installed at points *G*.



Nominal Joint Size, In.	Area of Largest Dia. of Corrugation	Nominal Joint Size, In.	Area of Largest Dia. of Corrugation
4	30.68	14	298.65
5	41.28	16	363.05
6	70.88	18	433.74
8	122.72	20	510.71
10	165.13	22	593.96
12	240.53	24	683.49

Fig. 17. Procedure for selection of expansion joints and anchors for pipe line illustrated.

Computations for the 12 in. section of pipe are given and are similar for other sections of the pipe line.

Expansion Joint for 188 ft of 12 in. pipe.

Expansion of 100 ft of 12 in. pipe
0 to 340F from Table 1* = 2.718 in.

Expansion of 100 ft of 12 in. pipe
0 to 60F = 0.449 in.

Expansion of 100 ft of 12 in. pipe
60F to 340F 2.269 in.

Expansion of 188 ft of pipe from 60F to 340F
$2.269 \times 188 \div 100 = 4.27$ in.

Expansion joint should be selected for 4½ in. traverse, from data furnished by the manufacturer.

Thrust at A for a stainless steel expansion joint
12 in. × 300** lb = 3,600 lb

Thrust at B for a stainless steel expansion joint
12 in. × 300 lb = 3,600 lb
240.53† × 100 = 24,053 lb

Total = 27,653 lb

*Heating and Ventilating, Jan. 1949, p 85.

**See description of joints shown in Fig. 1 and 2, Heating and Ventilating, Jan. 1949, p 85-86.

†See Table for Areas of Largest Diameter of Corrugations—Fig. 17.

Table 2—U. S. Spool Type Rubber Expansion Joints, Standard—Offset

(For 180F maximum working temperature)

Size ID, In.	Recommended W.P. Lb Per Sq In. Gauge Pressure		Allowable Axial Compression, In.	Allowable Transverse Deflection, In.
	Style 4140	Style 4150		
2-6	125	60	.43	3/8
8	115	60	.43	3/8
10	115	50	.43	3/8
12	115	50	.68	3/8
14	75	40	.68	3/8
16-20	60	30	.68	3/8
22	50	25	.81	3/8
24	50	25	.81	3/8
26-30	50	25	.93	3/8
34	40	20	.93	3/8
36-78	40	20	.93	1/4

Rubber Expansion Joints

Rubber expansion joints have given satisfactory service over a period of years on pipe lines in power plants, mines, ships, paper and pulp mills, water works and sewage disposal plants. They are not recommended for use at working temperatures in excess of 180F as rubber and cotton fabric will ordinarily deteriorate rapidly in high temperatures.

Occasional exposure to higher temperatures for a few hours at a time will do no harm, but when continual exposure to higher temperatures is necessary, special construction is required.

Rubber expansion joints are particularly suitable for chilled water and brine lines for air conditioning and refrigerating systems, circulating water lines to condensers, pump suction and discharge lines, air injection lines, and dry vacuum lines.

Advantages of rubber expansion joints, as pointed out by the manufacturers, are as follows:

(1) Light weight, which is very important on ship work.
(2) Insulation against transmission of vibration and sound through the piping system.
(3) No embrittlement due to continuous flexing of the joint as the flexing keeps the rubber alive.
(4) No corrosion or scale. Where oil is present in the water a joint with a synthetic lining may be used.
(5) High resistance to erosion.
(6) No gasket is required between flanges.
(7) Freedom from electrolysis, which is very important for salt water pipe lines.
(8) Minimum amount of stress is required to flex the joint.
(9) Small space requirement and ease of installation as no gaskets are required.

Bodies of rubber joints are made of fabric impregnated with rubber reinforced with solid metal rings for sizes 4 in. ID and larger, and with wire for the smaller sizes. The fabric is of high quality cotton duck, square woven to provide equal strength in both directions, and impregnated with rubber or synthetic friction.

To resist stresses set up when flange bolts are tightened, the duck used in flanges is tough and non-compressible, while the flange friction is compounded to give a high resistance to pressure. To provide maximum bond between the fabric carcass of the joint and the rubber lining, a joint of open weave "breaker" duck is inserted next to the lining.

Fabric plies are impregnated with long-lived rubber or synthetic friction and laminated into a unit, and the plies are welded under heat and pressure of vulcanization into a strong tough body. The friction permits flexibility between the plies of fabric to allow for service strains and distortion.

The lining which is the protective armor of the expansion joint is made of a single piece of specially compounded rubber which extends through the base and to the outside edges of the flange to prevent any possibility of leakage. Linings can be made of special compounds of natural or synthetic rubber to resist attack by acids, oils and other chemicals.

The cover is formed from natural or synthetic rubber compounded to withstand dry heat and painted with a special paint to provide protection against damage from occasional contact with oil.

When bolt holes are drilled in flanges, the edges of the plies thus exposed are thoroughly covered with self-vulcanizing rubber compound to seal them against absorption of moisture, oils, etc.

Spool Type Joints

The spool type joint is the most widely used type of rubber expansion joint. It is made in three forms:

Standard as shown in Fig. 18*a*; tapered, Fig. 18*b*; offset, Fig. 18*c*.

The most important advantage of the standard spool type joint is its compactness. For its length it gives a maximum expansion and contraction as shown in Table 2.

The arch of the joint provides this expansion and contraction feature. The normal range is from 7/16 to 15/16 in., depending on the joint size. To meet special conditions the arch can be made larger, and where expansion requirements are extreme, the joint can be furnished with multiple arches.

In Fig. 19 a spool type rubber expansion joint with a filled arch is shown. This type of joint is used where a large amount of solid material is suspended in the

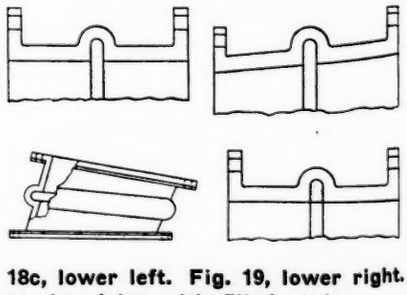


Fig. 18a, upper left. Standard spool type joint. The tapered model is shown in Fig. 18b, upper right, and the offset in Fig. 18c, lower left. Fig. 19, lower right. Spool type rubber expansion joint with filled arch.

fluid flowing through it. A low durometer abrasion resisting stock is used for the filler.

Flanges on rubber expansion joints should be full faced, fabric reinforced, smoothly finished with a rubber facing of sufficient thickness to form a tight seal against the corresponding flanges of the pipe or other apparatus to which they are to be bolted. This eliminates the need for separate gaskets. The use of full faced flanges of the same size as the companion metal flanges insures a tight joint with minimum bolt tension.

Split retaining rings of flat rolled steel which has been split and beveled as shown in Fig. 20 may be used to increase the resistance of the rubber joints to pressure. Placed directly against the flange of the expansion joint, as shown in Fig. 21, they are bolted through it to the metal flange of the pipe. Steel washers should be used at the point where the rings are split.

Elongation caused by shifting of pipe lines or connections may seriously damage rubber expansion joints. This can happen where pipe line connections are not anchored or where necessary support is not provided for the weight of the pipe line. Under such conditions a limitation of the destructive elongation can be achieved by the installation of the control units shown in Fig. 21. Each control unit consists of a long bolt and two connecting plates which are in turn securely bolted to opposite flanges. Each plate is drilled with three holes—two for bolting to the flange and a third for the passage of the stretcher bolt. Rubber washers backed with metal washers are placed under the head of the bolt and under the nut. Rubber sleeves may be placed over the bolts themselves if required to prevent transmission of mechanical noise.

The joint illustrated in Fig. 22 is for vacuum service only and was specially developed to insulate against vibration and dampen sound which would otherwise be transmitted through lines conveying coal-laden air to pulverized coal burners. It is supplied in standard pipe sizes from 10 in. to 42 in.

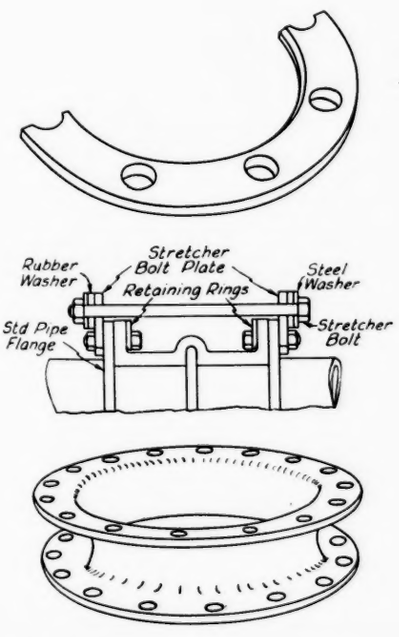


Fig. 20, upper. Split retaining ring. Fig. 21, center. Split ring against flange of expansion joint. Fig. 22, lower. Joint for vacuum service designed to dampen sound.

Split steel retaining rings are used in the installation of these joints and the bolt holes of the flanges are staggered where necessary to facilitate installation.

The internal flange rectangular type rubber expansion joint, Fig. 23, is primarily intended to serve as a flexible connection between turbines and condensers.

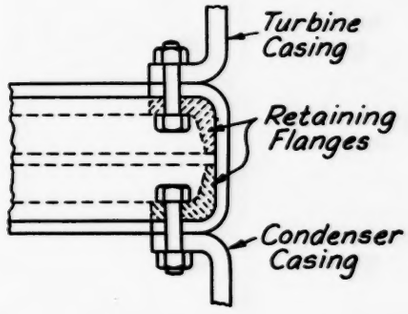


Fig. 23. Internal flange rectangular type rubber expansion joint.

Internal flange joints are used to provide the easiest possible installation. Retaining flanges are bolted into place against the fabric reinforced flanges to hold the expansion joint tightly against the condenser and turbine housings.

The sleeve type expansion joint, Fig. 24, is of similar construction to the standard spool type joint with the flanges eliminated. Joints of this type are used in applications where the ends can be slipped over straight pipe and held securely in place by King clamps.

Another well known manufacturer of rubber products furnishes the two types of rubber expansion joint shown in Fig. 25*a* and 25*b*.

The joint shown in Fig. 25*a* consists of two flat steel rings, with a 2 in. thickness of resilient pure gum rubber between them, the metal and rubber parts being integrally united with Vulcalock bond. These joints are inserted between pipe lengths at appropriate

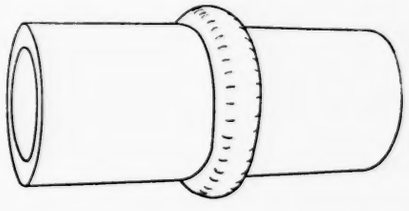


Fig. 24. Sleeve type expansion joint.

intervals and bolted snugly to the rubber faced pipe flanges. Each joint is designed to take as much as ½ inch stretch or compression.

The joint shown in Fig. 25*b* is built on the same principle, but with the addition of a steel pressure ring which is added to the outside circumference of the joint, preventing undue distortion of the rubber when under pressure.

Practically integral bonding of the soft rubber slab to the steel rings is required for the success of these joints.

They are primarily designed for use with rubber lined pipe. A 36 in. Vulcalock rubber lined acid sewer pipe was recently mounted on a series of steel rollers and equipped with expansion joints of this type.

Installation of Rubber Expansion Joints

It is first advisable to inspect the flanges to which the expansion joints are to be bolted to make sure they are clean and reasonably smooth. Old flanges which have been in use should be scraped clean of any old pieces of gasket or foreign material.

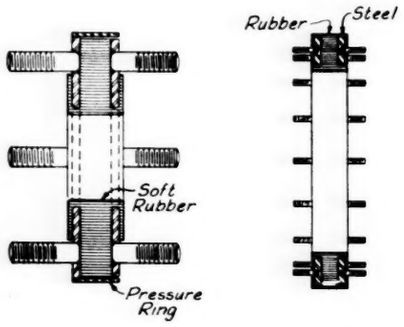


Fig. 25a, left, and Fig. 25b, right. Two types of rubber expansion joints.

The flanges should then be painted with a mixture of glycerine and graphite, which will facilitate removal of the expansion joint wherever changes are to be made. Use ordinary graphite mixed with enough glycerine to produce a thin paste so as to prevent possible adhesion between the rubber and the flange.

If it becomes necessary to remove a rubber expansion joint which has stuck to the pipe flange, carefully drive a number of small wooden wedges around the flange to loosen the joint evenly without damage. Careless use of prying tools may result in damage to the expansion joint and a serious reduction in its useful service life.

Provide necessary supports and anchors to relieve expansion joints of the weight of piping and be sure that the piping to be connected to the expansion joint is lined up as accurately as possible before installation of the joint. Standard joints should never be used when there is more than ⅛ in. misalignment. Where there is greater disparity than this, offset expansion joints should be used.

If possible, bolts should be installed with heads on the inner face of the retaining rings next to the arch of the expansion joint. Where an expansion joint is operating at temperature close to 180F, follow up the original tightening of the bolts in a week or so to compensate for the slight set which the rubber may take. Use care to avoid damaging the cover of the expansion joint during the installation. If the cover is torn even slightly by tools or bolts, coat the damaged portion with rubber cement so that no oil or water can work into the fabric.

Protect the rubber expansion joint against contact with oil and against temperatures higher than 180F and paint the entire outside surface of the joint once every four months with paint supplied by the manufacturers for that purpose.

Sliding expansion joints are available in several forms. Seven of these are described.

The semiguided expansion joint, Fig. 26, is of all bronze or brass construction and consists of a slip piece sliding inside a body piece provided with a stuffing-box, packing, and a large nut for tightening. This type of joint is commonly supplied in sizes up to 3 in. and is furnished with screwed ends only.

It is chiefly used in interior piping work on steam and hot water heating lines, domestic hot water lines, and for air, oil and gas services where conditions are not severe and where low first cost is essential.

When selecting joints of this type it is important that the actual traverse should be well below the maximum allowable traverse, in order to reduce the possibility of binding. The standard traverse is from 2¼ to 2¾ in. but traverse up to 8 in. can be obtained if required.

An internally guided expansion joint is shown in Fig. 27. The end of the sleeve piece, which is slightly larger in diameter than the main portion, is finished to provide a sliding fit inside the body piece. This tends to prevent the joint getting out of line and thus reduces the likelihood of binding. This type joint has the additional advantage that the slip piece cannot be pulled out of the body while in operation.

In Fig. 28 is shown an internally-externally guided expansion joint. The body is the same as for the joint shown in Fig. 27 but the slip piece has a flange near the end which is finished to provide a sliding fit inside a cylindrical extension on the nut.

This not only provides additional support to keep the sleeve in line, but also protects this member from the accumulation of dirt which might scratch the polished surface and score the packing. Inward and outward limit stops prevent disengagement of the body and sleeve. For underground steam heating mains where larger pipe sizes are required, iron body expansion joints with flanged ends are used.

An internally guided expansion joint with an anchor base is shown in Fig. 29; an internally-externally guided expansion joint is shown in Fig. 30.

The slips for sizes 3½ in. and smaller are made from polished bronze with a wide metal ring secured onto the end to serve as a guide and a stop piece.

For sizes 4 in. and larger, slips are of chromium plated steel with semisteel Van Stone flanges. The entire inner surface of the body on which the ring slides is carefully and accurately machined to provide perfect guiding. Bodies are made of semisteel and are provided with a recess in which sediment may accumulate without coming in contact with the sleeve

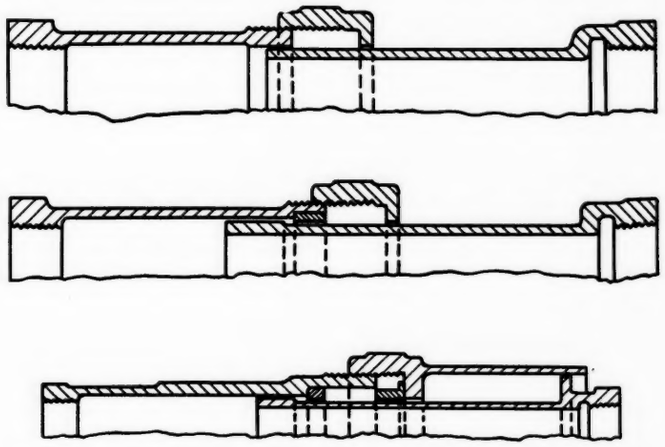


Fig. 26, upper. Semiguided expansion joint. Fig. 27, center. Internally guided expansion joint. Fig. 28, lower. Internally-externally guided expansion joint.

or guiding surface. The nut is replaced by a gland with a long lip to permit compressing the packing to 50% of its original depth.

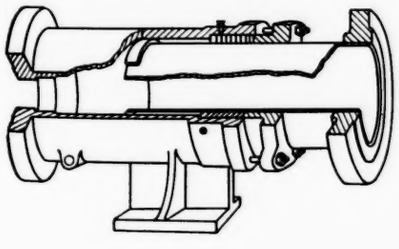
The internally-externally guided expansion joint, Fig. 30, is provided with a guide flange which has an outside diameter greater than the companion flange to which it is bolted. The sliding surface is machined to fit the external guide which is built in two halves and bolted to the body.

A tie rod type expansion joint is shown in Fig. 31. This type joint is similar to the semiguided type as far as the guiding of the sleeve is concerned, but it is provided with tie rods to limit the outward travel of the sleeve. The tie rods do not guide the sleeve and therefore this type of joint should not be used when a fully guided joint is required.

A piston ring expansion joint, Fig. 32, has an external guide of the split type similar to the regular internally-externally guided joints, but in addition a guide ring with grooves for piston rings is attached to the inner end of the sleeve. Between the guide ring and the packing space is a relief chamber with an external vent connection. When repacking the joint, a valve in the vent piping is opened and the pressure between the guide ring and stuffing-box is relieved through the vent. When in operation, pressure on both sides of the guide ring is the same, but with the vent open the piston rings hold back the steam so that what little passes the rings is exhausted through the vent. This design permits removing the packing gland to repack the joint without shutting down the line.

In Fig. 33 a duplex sleeve expansion joint is shown. This type joint is specifically designed for high pressure and high temperature service. Guiding is accomplished by an external guide provided with a limit stop to prevent the sleeve from pulling out of the body. A relief in the lip at the bottom of the guide prevents the accumulation of sediment. The sleeves are radically different from those employed in the conventional type of joint in that this member consists of an inner and outer sleeve welded together on the inner end, forming an angular space between them.

This space is open at the outer end to allow the free circulation of air and consequently the outer sleeve which bears against the packing is kept at a lower temperature than the inner sleeve which is in contact with the steam. As heat is responsible for packing deterioration, this air-insulated sleeve greatly prolongs the life of the packing.



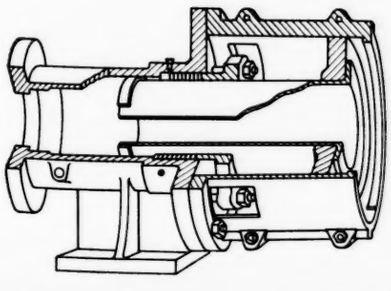
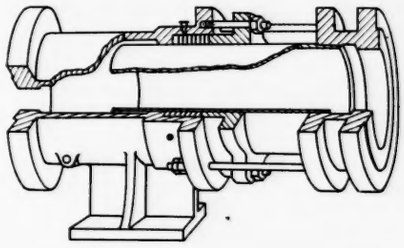


Fig. 29, upper. Internally guided expansion joint with anchor base. Fig. 30, lower. Form of internally - externally guided expansion joint.



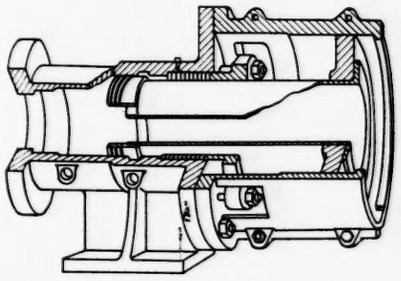


Fig. 31, upper. Tie rod expansion joint. Fig. 32, lower. Piston ring expansion joint.

A packless expansion joint, Fig. 34, is particularly adaptable to underground steam lines in conduits or tunnels where manholes cannot be used; to building or power plant piping in inaccessible locations; and, in general, to any service where space is limited. The expansion element consists of stainless steel seamless U rings welded together. Each unit is fitted with a traverse control ring which limits the amount of movement. Limit stop bolts combine with the control rings to distribute predetermined movement of the element. The expansion element is mounted on a chromium plated steel sleeve extending the length of the joint and is completely housed in a wrought or cast steel case. The sleeve is guided at both ends and in the body throughout the full traverse. A snap ring, mounted in the end plate of the body, prevents serious leakage of steam should the element be ruptured from any cause.

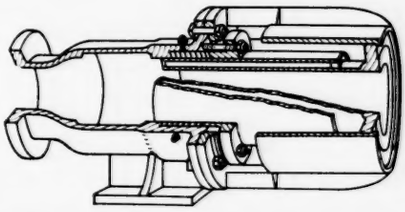


Fig. 33. Duplex sleeve expansion joint.

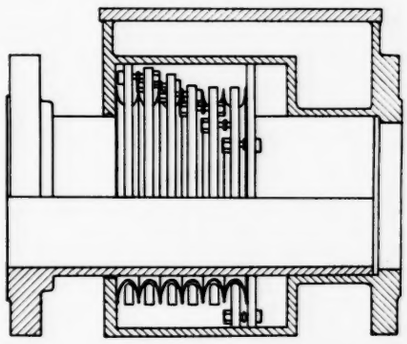


Fig. 34. Packless expansion joint.

Thermal Characteristics of a Heated Concrete Floor

A report of the British Electrical and Allied Industries Research Association, drawn up by M. V. Griffith, is extracted in a recent issue of the Journal of the Institution of Heating and Ventilating Engineers. The report deals with a series of tests undertaken to determine the thermal characteristics of a concrete floor heated by buried electric cables. The effectiveness of a heated concrete floor as a means of background heating and as a carrier of off-peak energy loads is discussed. Following is a further condensation of the report which was originally published in England by BEAIRA as Ref. Y/T11.

A METHOD of space heating in which heat energy is absorbed during the "off-peak" period and given off slowly during the peak period, to maintain conditions of "background heating" has obvious advantages. A solid concrete floor heated by buried cables is an example of such a method.

In order to study the conditions of heat flow in this type of structure and to determine the energy necessary to obtain the desired temperature differences, an experimental floor was laid inside a specially constructed test-room.

The floor itself covered an area of 100 sq ft, the volume of the room enclosing it being approximately 700 cu ft. The construction of the floor was 6 in. of hard core, 3½ in. of concrete, a layer of waterproof felt, and then 2 in. of concrete topped by ½ in. of screed. The cables for heating were laid directly on the upper surface of the waterproof asbestos felt used. The total wattage applied to the floor could be varied up to 1,450 W (14.5 W per sq ft).

The ambient temperature external to the test-room could be maintained constant to ± 1F when necessary. A globe thermometer with a thermocouple suspended in the centre was used to measure the equivalent temperature in the test-room, while an exactly similar device but containing an air thermostat was placed very close to it.

"Background heating" is taken to be such that 55F equivalent* temperature is constantly maintained whatever the external ambient conditions. For the tests carried out, the walls and ceiling represented probably the worst conditions likely to be found in practice. No insulation was applied, the walls being only one brick thick (4½ in.). The calculated effect of adequate insulation was determined.

**British equivalent temperature* (BET). A composite of MRT and air temperature, also defined as the mean temperature of the environment effective in controlling the rate of sensible heat loss from a black body in still air when the surface temperatures and size of the black body are comparable to those of the human body. Where the enclosure surface (MRT) and air temperatures are equal, this temperature is also the BET; when not equal, the BET is that temperature at which a body with an 80F surface temperature will lose sensible heat at the same rate as in the given environment.

Action of a Heated Floor

The arrangement described is a "quasi-steady state" in which temperatures are changing so slowly, that for periods of weeks, conditions may be taken as constant. Assuming this, and that absolute accuracy is not necessary, some practical conclusions can be drawn.

Suppose, therefore, that W watts of thermal energy are being generated by electric cables buried in the concrete floor described, and that a "quasi-steady state" has been achieved.

Part of the energy will travel through the upper concrete slab to the air in the room, then through the walls and ceiling to the atmosphere. The remainder will travel downward into the earth. The relative fractions may be determined by the thermal resistances of these two paths,

$$\frac{W_2}{W_1} = \frac{R_1 + R_s + R_w}{R_2} \qquad (1)$$

where

$W_1 + W_2 =$ W watts (total input).
$R_1 =$ Thermal resistance of the floor slab above the cables.
$R_2 =$ Thermal resistance of the earth below the cables.
$R_s =$ Equivalent resistance of the floor surface to air and surroundings.
$R_w =$ Resistance of the walls and ceiling of the room to the external ambient temperature.

The fraction of the total energy input travelling upward is more useful in the discussion,

$$\frac{W_1}{W} = \frac{R_2}{R_2 + R_1 + R_s + R_w} \qquad (2)$$

and all calculations have been made in terms of this.

Observations over a range of total input from 340 to 1,450 watts with outside ambient temperatures from 46.4 to 82.4F showed that, for the bare floor described, from 59 to 77% (with a mean of 64%) of the total input was delivered upward. When ½ in. of composition flooring surface (resistance .0069) was added, the fraction of total input delivered upward was 58%.

Resistances used in Equation (1) and (2) were determined from available published data and the effect of various structural changes upon the upward fraction of heat calculated. These calculated values,

checked against the measured values already mentioned, are shown in Table 1.

Table 1 — Fraction of Heat Travelling up from Cables for Various Floor and Wall Constructions

Floor Construction	Measured Fraction of heat, up	Calculated Fraction of heat, up
1. Bare concrete floor—cables 2.5 in. below surface—U for walls = 0.44	0.64	0.67
2. Same as (1), but cables 5 in. below surface	....	0.62
3. Composition flooring surface—cables 2.5 in. below concrete surface—U for walls = 0.44.....	0.58	0.60
4. Bare concrete floor—cables 2.5 in. below surface—walls insulated—U = 0.22.....	....	0.60
5. Composition flooring surface — cables 2.5 in. below concrete surface—U = 0.22.....	....	0.55
6. Bare concrete floor—cables 2.5 in. below surface—1 in. cork directly below cables—U = 0.22.....	....	0.78
7. Same as (6), with 2.5 in. cork directly below cables.....	...	0.86
8. Composition flooring surface—cables 2.5 in. down — room insulated — U = 0.22, 2.5 in. cork directly below cables.....	....	0.79
9. Bare concrete floor—cables 2.5 in. below surface—1 in. cork 6 in. below surface—U = 0.44 for room	....	0.80
10. Same as (9), but 2.5 in. cork 6 in. below surface	...	0.86

Greater economy of energy consumption and a more tolerable floor surface temperature (for the same equivalent room and external ambient temperatures) may be obtained by providing thermal insulation on the walls and ceiling of the room rather than by increasing the thermal resistance of the earth-path below the cables. This is because, with insulated walls and ceiling, less heat energy is required to maintain the required equivalent temperature in the room and the floor surface temperature is consequently reduced, which more than compensates for the increase in the fraction of the total energy input lost downward to the earth.

The theoretical expressions have been used to calculate the heating power necessary to maintain specific temperature differences under various conditions and for several methods of construction with results given in Table 2 on the following page.

When the system described was shut off after reaching equilibrium, a 5½-hr cooling period showed the following temperature drops at various points:

Reading Point	Temp., F Before Shut-off	Temp., F 5½ hr After Shut-off	Total Drop, F
Floor Surface	79	65	14
Globe Thermometer	55	49	6
External Ambient	30	32	—2
Concrete-hardcore interface..	77	70	7
Hardcore-soil interface	68	67	1
Center of lower concrete....	88	74	14

While most of the heat travelling downward is wasted, the slow rate of cooling of the lower concrete raft does ensure that the heat from the upper raft is lost to the air after shut-off as its temperature remains higher than that of the air and floor surface for many hours. After a considerable period, some heat will actually pass from the lower concrete up through the felt to the surface. This occurs too late in the cooling process to be really useful, however.

The thermal capacitance associated with floor heating is large so that the time constant is long. With the construction described, although approximately 160 hours are needed to achieve constancy of temperature in steady ambient conditions, the floor surface temperature rises to six-sevenths of its final value in 36 hours.

It appears that a fall of 5F in the globe thermometer reading may be expected in 5 hours when the external temperature is 32F. For an ambient of 45F, the fall is only 4F in 10 hours. With the walls of the room insulated (U = 0.22) the rate of cooling should be halved.

Floor Coverings and Furniture

It was found that an increase of 12.5% in the total wattage consumed with an ambient of 30F is needed with the composition floor over that required for the bare concrete floor.

The type of furniture which rests flat on the surface of the floor will prevent local heat loss and so raise the temperature of the surface beneath it. The effect of furniture of this type, and also of a mat applied to the composition surface is to produce an appreciable rise of temperature (16F) which does not by any means reach dangerous proportions. The area of the object representing furniture which was used was 2 ft, 6 in. by 2 ft, 6 in. and the mat was 2 ft by 4 ft.

Other floor coverings such as carpets, linoleum and tiles were also used with similar results depending on the thickness and conductivity. The additional resistance in all cases evened out the surface temperature distribution but increased the energy input necessary to achieve "background heating."

All tests reported were carried out under ventilation conditions of 0.75 air changes per hour.

Conclusions

1. A solid concrete floor is a practical means of obtaining "background heating" (equivalent temperature up to 55F) in domestic rooms—particularly when the walls of these rooms are adequately insulated.

2. The necessary floor loading in W per sq ft will vary with the thermal transmittance of the structure of the room and with the external ambient temperature. For example, at an external ambient temperature of 32F, increasing wall insulation from a *U* of .44 to .22 decreases the electric load from 14.9 to 8.4 W per sq ft.

3. The amount of heat energy wasted by travelling downward into the earth was about 30 to 40% with poorly insulated walls. This fraction may be reduced to between 15 to 20% by placing insulation below the floor. The effect of a surface covering is to drive more heat downward.

4. Such a floor is particularly suitable for thermostatic control, a differential of ± 1F in the equivalent temperature being maintained under greatly varying ambient conditions.

5. In the experiments, with a floor area of 100 sq ft and of 6 in. thickness, the thermal capacitance (storage capacity) was found to be sufficient to provide an upward flow of heat for 2 to 3 hours after switching off. It was possible to keep the equivalent temperature in the room within 5F of 55F even when the external temperature was 32F and the cables had been switched off for 5 hours. With a higher ambient temperature the cooling was much less. An "off-peak" supply of 21 hours "on" and 3 hours "off" caused little temperature disturbance.

6. Electrical energy may be saved either by insulating such a floor below the cables or by adequate insulation of the room. With the test floor it was estimated that 22% of the energy required to produce "background heating" with an ambient of 32 F with the present construction might be saved by placing 2.5 in. of cork or insulation beneath the cables, while 44% might be saved by insulating the walls and ceiling to U = 0.22 (test-room value of U = 0.44).

7. As regards the insulating effect of the floor covering, thin linoleum is the most economical, but even a well-known composition tile, which under these conditions appears to be a fairly good insulator, requires only 12.5% extra energy to maintain background heating at 32F external ambient without extra insulation below.

8. Local temperature rises of the floor surface are produced by mats or furniture, the whole area of the base of which is in contact with the surface. These do not, however, reach dangerous proportions with furniture and mats of size likely to be used in domestic rooms.

9. A notable advantage with this type of heating is the uniformity of the temperature conditions obtained throughout the room, resulting in a very small temperature gradient between floor and ceiling and low ceiling losses.

Table 2 — Heating Power Required for Specified Temperature Differences — Various Floor Constructions (Calculated)

Condition of Floor	Globe Temp. in Room, F	External Ambient Temp., F	Total Watts	Watts per Sq Ft	Floor Surface Temp., F	Cable Surface Temp., F
1. Bare concrete floor, as described in report (average U for walls and ceiling—0.44), cables 2.5 in. below surface	55	32	1,490	14.9	79.0	109.5
		41	918	9.2	70.0	88.6
		50	328	3.3	60.0	67.0
	60	32	1,850	18.5	88.6	
		41	1,240	12.4	79.8	
		50	652	6.5	70.5	
2. Composition flooring surface, walls and ceiling as 1	55	32	1,670	16.7	79.0	133.0
		41	1,025	10.3	70.0	101.3
		50	367	3.7	60.0	72.3
3. Bare concrete floor with insulation added to walls and ceiling (average U = 0.22)	55	32	840	8.4	67.1	
		41	512	5.1	62.4	
		50	182	1.8	57.7	
	60	32	1,020	10.2	74.6	
		41	692	6.9	70.0	
		50	363	3.6	65.5	
4. Composition flooring surface, walls and ceiling average U = 0.22)	55	32	918	9.2	67.1	
		41	558	5.6	62.4	
		50	200	2.0	57.7	
5. Bare concrete floor, cables 5 in. below surface (U for walls = 0.44)	55	32	1,615	16.2	79.0	117.5
		41	990	9.9	70.0	93.5
		50	355	3.6	60.0	68.8
6. Bare concrete floor, cables 2½ in. down, 1 in. cork directly below cables (U for walls = 0.44)	55	32	1,280	12.8	79.0	
		41	790	7.9	70.0	
		50	282	2.8	60.0	
7. Same as (6), but 2.5 in. of cork directly below cable	55	32	1,162	11.6	79.0	
		41	716	7.2	70.0	
		50	256	2.6	60.0	
8. Composition flooring surface, insulated room (U = 0.22) 2½ in. cork below cables	55	32	640	6.4	67.1	
		41	389	3.9	62.4	
		50	139	1.4	57.7	

Experience is my Classroom

By T. W. REYNOLDS

IT SOUNDS NICE, BUT—

A book tells me that where one has duplex condensation pumps, one of which is a standby, he should arrange their control automatically to alternate the operation of the pumps. With this method either unit would have the normal required capacity, but two could be run together at extreme peaks. The book says that this method will equalize the wear on both units and the standby unit will not deteriorate through idleness.

The writer has found the reverse to be true. If a pump is run a short time, then stopped and the other pump run a little while, the two pumps wear equally and end up more or less worn out together. Also, when one pump gives trouble, the other pump suddenly lets go at the most inopportune time.

EXHAUST OUTLETS

A restaurant kitchen under a powerful suction from many exhaust hoods will theoretically receive the necessary make-up air through the many doors and other openings from the adjacent spaces. The hoods, however, vary in capacity and suction, while the make-up air will enter mainly by one door and more or less neglect another door close by, due to some slight difference in resistance one could hardly measure. The result is drafts and the remedy is one of multiple supply outlets for make-up air directly within the kitchen.

Exhaust fans in kitchens are often left without any provisions for make-up air other than such as it is thought will be provided by large open areas. Now, except for a brief initial operation, there is no more air that can be sucked out of a big bag than there is out of a little one, providing the holes in each bag are the same in size, number and location.

The near hole does all the work, as the writer found out when closing some supply outlets just outside of a restaurant area which was under a certain amount of exhaust. No sooner were the supply outlets closed than the make-up air normally furnished by these outlets was supplied instead by the chimney from the beautiful fireplace in the center of the restaurant area. Since this happened to have a cozy fire in it at the time, all the smoke circulated throughout the restaurant before normal conditions could be restored.

Theoretically, the exhaust outlets should have drawn upon the large area outside, but points of infiltration out there were too far away. Drawing air from large areas has the further disadvantage of dust in the air increasing with the distance the air travels. Unfortunately, much of this dust will settle out within the exhaust ducts.

ECONOMIES OF RADIATOR DESIGN

What are the economies in radiator design? The tendency, of course, is to obtain the greatest heat emission for a given weight of iron with the least floor space. In the development of the slenderized radiator, now common to all manufacturers of radiators, all of these things were taken into account. Radiators with sections on various centers and with tubes of various sizes were all tried out. In the final analysis, it is volume production that counts the most. This calls for the elimination of the less called for sizes. Some core making machinery is not economical to operate unless there are substantial orders on hand.

FUEL OIL PIPING

A correspondent asks two questions. The answers may be helpful to those who occasionally install fuel oil installations.

(1) Is a return line from oil pumps to an outside fuel oil tank necessary where the top of the tank is below the level of the oil burners?

(2) Is a separate suction line required from the tank to each burner or can all burner pumps take suction from a single line?

(1) For industrial installations using a heavy oil, a return is required in all cases and is preferred by oil burner manufacturers to keep the oil hot in the tank. Where one pump shuts off, there is a further advantage, since the return acts as a relief. There would otherwise be a back pressure on the remaining pumps.

For industrial installations using a lighter oil, the answer does not depend so much upon the elevation of the tank with respect to the burner, whether above or below, as it does upon whether the feed is by gravity or suction. For example, if a burner pump takes suction from the top of a tank, it has a suction lift, even where the burner and tank are set upon the same floor. For domestic installations, a by-pass at the pump will churn the oil around from pump discharge back to suction line.

(2) Several burners can be operated from a single suction header. In such cases, each suction connection should have a ball check in it to prevent the suction of the other burner pumps from removing the prime from a shut-off burner pump.

SAVING VS. SPENDING

An old friend liked to tell me on more than one occasion that he had become convinced the only way to make money was to save it. So he saved his money, the depression came and passed and so did his money. This would seem to disprove his theory and to prove that he might as well have spent, for he too passed on and had no use for money.

Where money is scarce or seldom seen, the pennies must be watched; nevertheless, the writer leans more to the idea that money is best made by spending it. For example, a department store with a highly seasonal trade will probably watch the overhead quite closely in off-peak periods, but overhead in the peak periods may be of no moment compared to gross volume. It is in the dull periods that the lights are carefully watched, thus saving electricity and reducing heat gain. Let's turn on the air conditioning later and shut it off earlier in the day and in the season; let's use less outdoor air when cooling or let's use all outdoor air and shut off the refrigeration, and so on.

There is one store where business seems always good, for many lights are burning for considerable periods when they need not be. The management says that every time it starts a campaign of economy, too many employees take it too seriously. Employees become so concerned that one soon finds display lights turned off when they might be doing good advertising at nearly all hours, while service men stop asking for things which economize.

No doubt these two cases represent extremes between which one should chart a middle course. The disregard for expense in boom periods is also exemplified by the case of the sales manager riding the crest of a sellers market and paid a large salary for bringing in a lot of business of which much would have come in anyway.

NOTE: Mr. Reynolds is Chief, Air Conditioning Division, Abbott, Merkt & Co., Engineers, New York.

Meanwhile, the salesman is urged to spend on entertainment and does so all out of proportion to returns. Then come the lean days, the sales manager is fired for not getting in a lot of business which doesn't exist and the salesman is urged to spend nothing, even where it might have paid good returns.

ODORS AND HUMIDITY

Not long since, the writer was experimenting with the relative positions of the minimum and maximum dampers at an outdoor air intake and noticed an odor present when the entering air was kept down to about 25% of the total air circulated by the fan. However, when both dampers were opened wide to intake the full amount of air circulated by the fan, no odor was present. Obviously, the greater amount of air diluted the odors to where they were no longer noticeable. Thus, it happens that odors within an air conditioned space attributed to some source within the space are sometimes of foreign origin, being too diluted at the so-called fresh air intake to be apparent.

Another interesting observation is that a smoke test may show all smoke going from an air conditioned space through openings to a kitchen, indicating that the kitchen is under suction, as it should be. Apparently, then, any odors within the space are not coming from the kitchen, yet they may be, for moisture at higher vapor pressure can travel against the flow of air to places at lower vapor pressure. Odors are always more noticeable as the humidity increases.

FOUL AIR RECIRCULATION IS COMMON

Not infrequently it becomes a problem as to how to prevent the foul air discharged out of a building or buildings from being recirculated back to a building by way of the open window or the fresh air inlets to fans. The more numerous the fresh air and exhaust openings, and they often are numerous with large buildings of several stories, the more likely the difficulty.

Sometimes the outlets and inlets are near together, though strangely enough there may be no difficulty with short circuiting. Again, they may be far apart, yet with a recirculation sufficient to become a nuisance, for a solid stream of air projected outdoors from an exhaust fan may be deflected by strong winds to a fresh air inlet without diffusion or dilution to the extent commonly thought. This brings up the thought that without doubt there are many places where foul air is being recirculated without the knowledge of anyone, simply because the proportion of odor in the mixture is not great enough to be detected.

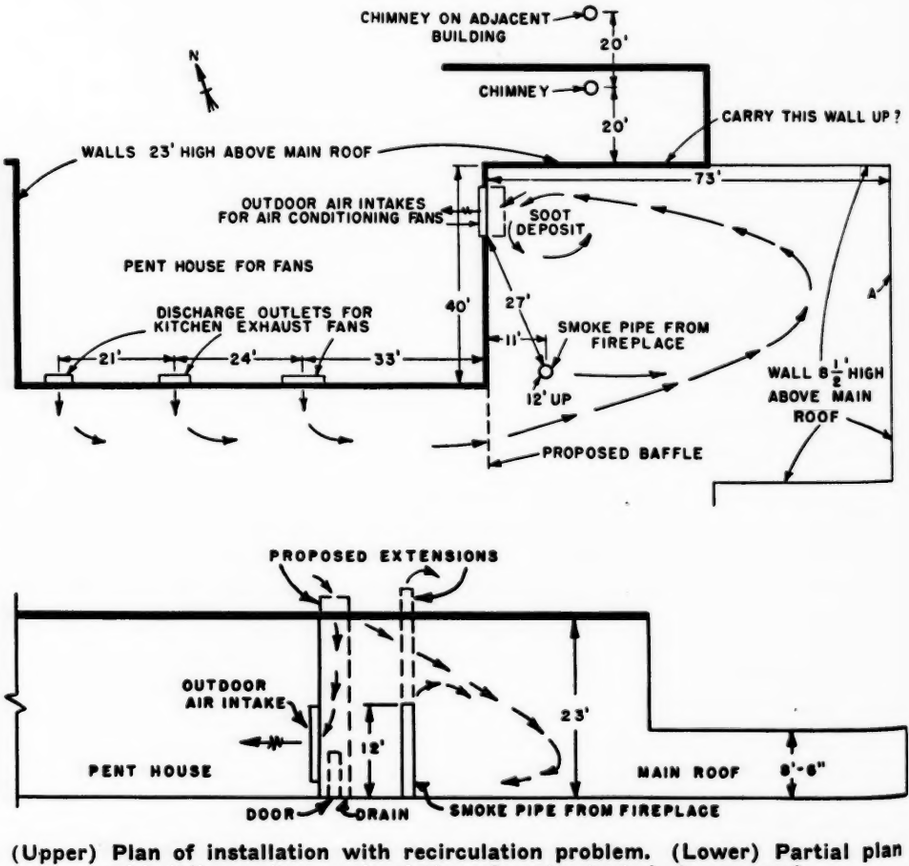
The accompanying sketches in plan and elevation illustrate the condition in mind. Here, there are several fans exhausting from range hoods, dish washers and bake ovens of a kitchen below, and all discharging along a penthouse wall as wiped by prevailing winds. Here, also, is the smoke pipe from the wood burning fireplace in the restaurant below, while not too far distant are two chimneys, which, upon rare occasion, when the wind is of another direction, add soot to the other nuisance of odors.

All of these foul air outlets are at some distance from the inlets and in some cases are even located as shown on a wall at right angles to the wall containing the fresh air intake; nevertheless, the recirculation of odors from foul air outlets to fresh air intake is quite noticeable. Unfortunately, this combination of unhappy circumstances seems to be caused by no other than the enclosing walls at point *A* in the sketch. This is a wall that is low enough to prevent the foul air from being spilled over the end of the building to where it could do no harm, yet high enough to block and turn the air so as to cause it to eddy around and shortly to enter the fresh air intake.

With the aid of a simple smoke device, this circuit of the foul air was clearly traced, as shown by the arrows, yet until this test was made the nuisances were attributed to other routes. For example, a small grease fire on a kitchen range was soon made evident by smoke in the adjacent restaurant, and this smoke was said to have entered through connecting doors, although the restaurant was under air pressure from air conditioning while the kitchen was under the suction of exhaust fans. As for the odor of wood burning from the fireplace, this was wrongly attributed to downdrafts in its chimney, even though none was observed.

Since the physical conditions in this particular building were such as to prohibit any other location of inlets and outlets, various remedies have been proposed as shown in ——— on the sketches. Thus, the fireplace vent could be carried well up above the adjacent roof to prevent deflection downward from winds spilling over the edge of the penthouse roof. The vertical extension, however, is not needed if the fresh air intake is carried well up above this same roof so as to get above both the downdrafts over the roof and the foul air circuit below. This extension would be open at the top and also open at the bottom, the latter just sufficient for the purpose of shedding rain.

Annoying downdrafts with drifts of soot from the two chimneys might be prevented by carrying the wall at *B* up a bit, but this should not be necessary if the fresh air intake is carried up above the drift on the roof. The existing wall at *A* and the proposed wall at *B* constitute baffles, but the first mentioned wall is a detriment while the second would be considered an advantage.



(Upper) Plan of installation with recirculation problem. (Lower) Partial plan of buildings where recirculation of contaminated air occurred.

THE SALES ENGINEER

The Importance of Following Through

BERNARD LESTER
Sales Engineering Consultant

SELLING heating and ventilating equipment is not a "one-shot" job. The sales engineer must make repeated calls. He must approach from a variety of changing angles. His power and drive must increase rather than diminish.

Every experienced sales engineer understands that selling is a race, and unless the last tenth of a percent of effort is expended, he has nothing left except experience, customer good will and possible obligation.

Following up the negotiations is consequently of enormous importance, because only through added investment in time and effort can past investment be made to yield.

Though following the negotiation is important, a lot depends upon just how it is done,—upon the manner in which each move is made.

The complexion of each pending order changes with additional sales effort and with the prospect's reactions and circumstance. This means that the results of each call should be analyzed, and the next move planned accordingly.

What new facts are discovered?

What new objections have come up?

What new face has appeared in the array of competitors?

Answers to such questions lead on to others.

What new selling resources can be tapped?

What new selling device and strategem can be used?

Where can the sales engineer get help?

How about the timing of the next move?

Here are some suggestions to the way most pending negotiations may be followed up:—

1. "Button up" every interview. That is, come to a conclusion with the prospect upon what he and you are to do next. It may be on your part supplying additional information—a written proposal, a blueprint, supporting evidence of savings, a segregation of price, etc. Set a time also, when you are to act, so that further proof can be given of your next interest and intent. In fact, set the picture of the stage for the next interview.

2. Often on the first or a subsequent visit the prospect will try to block you out. As a last resort always try to get a commitment from him that no decision will be made until you can present additional information or facts that will melt his question in point.

3. After the interview, while the prospect's objections are vivid, make a prompt evaluation of all that has come up, conjure up every resource to be employed and plan the next move.

4. Recently I heard a sales engineer call up a customer. His words were these:—"I just called you up to find out how my bid for blowers is coming along." It was doubtless well to make an inquiry, but wouldn't the sales engineer's position have been stronger if he had a supporting reason for the question,—one of interest to the prospect. It might have been framed in this way:—"I have some very interesting data in connection with that job we have up for blowers that shows our improved system of lubrication. Would you like it? Can get it out in the mail today." Such a followup shows interest, provides an additional selling argument and opens the way to find how the job stands.

5. Then there is the matter of additional information to reach the prospect as a plus selling tool after the call. It may be a carefully selected pamphlet, a clipping, copy of good advertisement, technical article, photograph, or tabulation of performance results. Such a message helps to establish the sales engineer and his interest in the prospect's mind. It keeps the selling process alive.

6. In following up negotiations few helps are more effective than recommendations or a good word from others. Every purchasing engineer wants freedom in making a decision, yet each is influenced by outside forces,—perhaps a consulting engineer or contractor,—perhaps a bank or a local business man, or perhaps a good customer. Every successful sales engineer has friends. He supports them and likewise is quick to use their support, and at the right time.

7. Judgement in timing the followup counts for a lot. In many cases the sales engineer either follows up the job immediately, often irritating the prospect, or neglects the prospect and allows opinion to crystallize against him. One purchasing engineer made the remark:—"Tom Murphy was here three weeks ago and put up a great sales talk, but I haven't seen him or heard from him since."

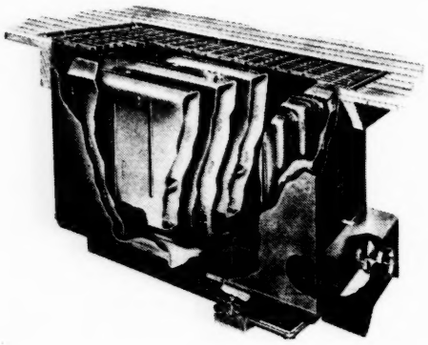
Selling is a continuous process. The brilliant sales engineer who flashes into action, and tries to do the job in half an hour, should be selling some forms of merchandise. Capital goods—industrial investments—are not sold that way. The race may be long but the prize is commonly won by the man who keeps everlastingly at it. Some twenty-three centuries ago Aesop wrote the fable of the hare and the tortoise. It is true today as it was then. The tortoise had his plan. It was to steadily *keep going* in the exact direction of his goal.

NEWS OF EQUIPMENT AND MATERIALS

Included in the following pages of this department are descriptions of new equipment exhibited for the first time at the 9th International Heating, Ventilating and Air Conditioning Exposition in Chicago, not previously described in Heating and Ventilating. Such items are marked "Exhibited at Chicago."

Floor Furnace

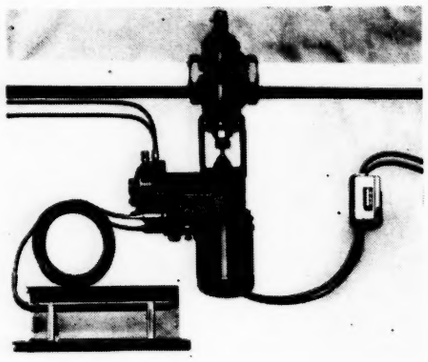
NAME—Superfex floor furnace.
PURPOSE—Space heating.
FEATURES—Standard equipment includes manual control, automatic safety pilot control, and a gas pressure regulator. A drilled port blue flame burner and baffled flue radiators are used. Inner and outer jackets are of rust-protected steel. Draft diverter neutralizes downdraft tendencies. Burner is supplied for operation with natural, manufactured or liquefied petroleum gas.



SIZES AND CAPACITIES — Available in three models—F-35, F-50, and F-65, with inputs respectively of 35,000, 50,000 and 65,000 Btu. Floor opening varies from 13⅜ x 36⅜ in. to 24⅜ x 36⅜ in.
MADE BY—*Perfection Stove Company, 7609 Platt Ave., Cleveland 4, Ohio.* **26**
Exhibited at Chicago

Control Valve

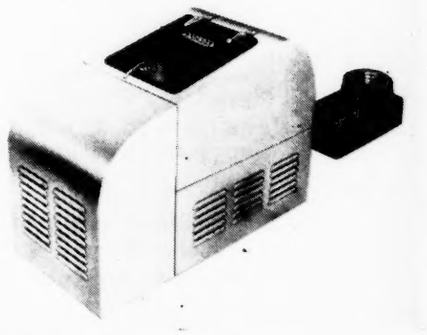
NAME—Sarco type EO-1 control valve.
PURPOSE—Valve to automatically maintain steam at desired pressure in the heating system in accordance with outside weather conditions.
FEATURES—Valve is constructed with a double seat and is normally closed. A small connecting pipe transmits the pressure in the heating main to the bellows in the chamber so that any pressure change in the system is transmitted to the outside of the bellows. Outside thermostat is connected with a capillary tubing to a small bellows and the thermostat is designed to actuate the plunger in accordance with outside temperature. Any movement of either of two plungers will move a link which in turn operates electric switches. Adjustment to either raise or lower the steam pressure to meet building demands can be made by turning a knob. Once these manual adjustments have been made for a particular system no additional adjustment is necessary during a heating season.



MADE BY—*Sarco Co., Inc., 350 Fifth Ave., New York, N. Y.* **27**
Exhibited at Chicago

Stoker

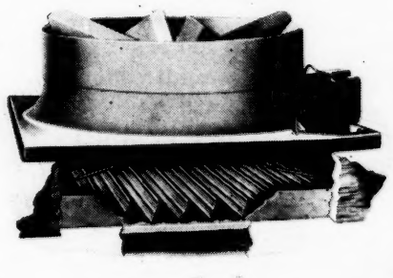
NAME—Chieftain stoker.
PURPOSE — Bituminous stoker for use in small homes.
FEATURES—Hopper is of one piece welded construction with ⅛ in. steel plate fitted around the worm section of the hopper. Motor is of capacitor type with thermal overload protection. Coal worm is of cast alloy steel. A Sirocco type fan, dynamically balanced, is used. The retort is tapered to provide even distribution of coal for good performance. Tuyeres have port holes of the Venturi type to prevent fly ash and small clinkers from clogging and settling in windbox. A three-speed V-belt transmission is installed.
SIZES AND CAPACITIES — Available in 20 and 35 lb models.



MADE BY—*Anchor Division, Stratton & Terstegge Co., Inc., New Albany, Ind.* **28**
Exhibited at Chicago

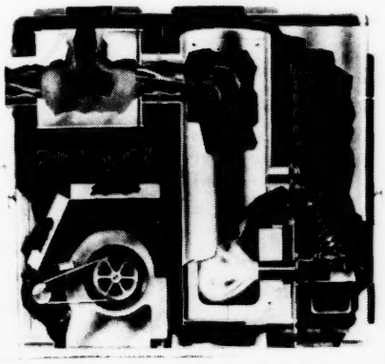
Attic Fan

NAME—Fresh-Air maker.
PURPOSE — For removing air through a ceiling opening where attic space is limited.
FEATURES—Motors are of the ball bearing type with pre-lubrication. The solid frames in which the venturi, frame and stiffening angles are formed, are made from one single sheet. The four deep pitched wide blades, the spider on which the blades are mounted, and the bearing housing, are all of welded construction. Units can be had as packaged fans with automatic ceiling shutters or grille and with controls, if desired.
MADE BY—*Schwitzer-Cummins Co., 1145 E. 22nd St., Indianapolis 7, Ind.* **29**
Exhibited at Chicago



Furnace

NAME—Petro model A-75 oil-fired warm air heating unit.
PURPOSE—Space heating.
FEATURES—A special oil burner was designed for this unit which consumes only ¾ gal of oil per hr. Quick access is provided to ignition and oil lines. All wire connections are protected on the inside and unit is fitted with a continuous heavy duty radio shielded transformer. Cool air returns to the heating unit through passages which warm this air supply, and then this air travels through the dust filters before circulating around the hottest part of the furnace. A blower expedites this heat exchange.



SIZES AND CAPACITIES — Register rating is 75,000 Btu per hr, motor is 1/6 hp operating at 654 rpm. Blower capacity is 900 cfm maximum.
LITERATURE AVAILABLE—Illustrated folder.
MADE BY — *Petroleum Heat and Power Co., Stamford, Conn.* **30**
Exhibited at Chicago

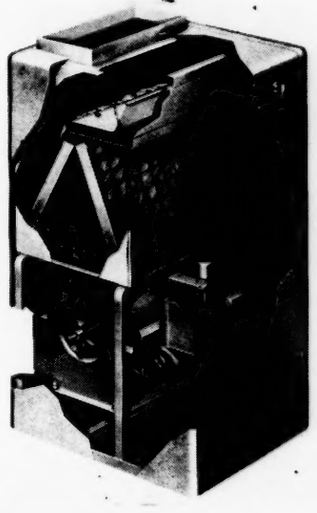
Furnace

NAME—Thatcher series 481 coal-fired furnace for winter air conditioning.
PURPOSE—Space heating.
FEATURES—Circulation of room air is maintained by a slow running pressure type blower powered by a motor operating through a variable speed drive. This entire assembly is set on rubber cushions. At the option of the installer, blower may be placed either on the right or the left of the heat exchanger. Water coil ports are provided for application of a thermostatic hot water unit. Metered air flow between the inner casing and the outer cabinet is said to hold down the unaccounted for heat losses to the basement. Furnace is of welded construction and a large combustion space is provided for better utilization of the fuel.
LITERATURE AVAILABLE—Illustrated folder.
SIZES AND CAPACITIES—Three sizes —112,000 Btu per hr, 134,000 Btu per hr, and 158,000 Btu per hr at bonnet.

MADE BY—*Thatcher Furnace Co., Garwood, N. J.* **31**
Exhibited at Chicago

Air Conditioner

NAME—TEG air conditioner.
PURPOSE—Self-contained unit for the home to clean the air and control the humidity of air passing through it.



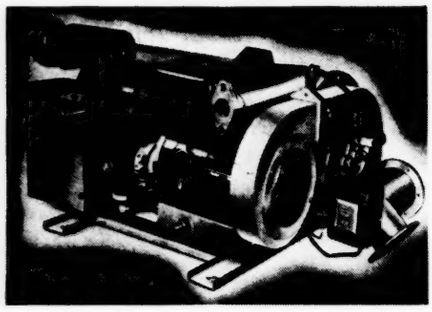
FEATURES—The motor driven blower draws air through the unit over a glass fiber filter cell which is saturated and flushed continuously by liquid Tegelene circulated by a small sump pump. Residue dirt is continuously washed off the cell by liquid flushing action. Liquid also humidifies the air. A small amount of triethylene glycol vapor is picked up by the water. An automatic float valve located in a sump tank admits water that may be required. By automatically maintaining a fixed concentration of water solution, the relative humidity of air in contact with the solution is controlled. Although used primarily in conjunction with warm air heating, makers claim it can be installed to operate in connection with a steam or hot water heating system.
MADE BY—*National Air Conditioning, Inc., Johnstown, Pa.* **32**
Exhibited at Chicago

Unit Heater

NAME—Carrier unit heater.
PURPOSE—Space heating by steam heat or hot water.
FEATURES—Unit is constructed of one-row Aerofin coils of continuous U-bend copper tubing brazed into steel headers. Deep fins are said to provide better heat transfer. Supply and return pipes are concealed in the rear. Unit can be disassembled by removing four bolts and four screws. Available in many sizes and capacities.
MADE BY—*Carrier Corp., Syracuse, N. Y.* **33**

Engine Heater

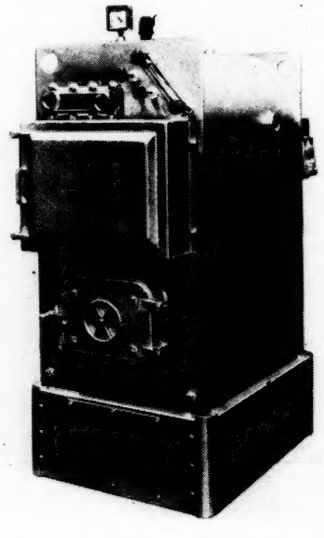
NAME—Petro engine heater.
PURPOSE—To pre-heat cold engines of gasoline or diesel operated coaches prior to cold starts, or to supply extra heat as needed for



proper coach temperature when engines cannot supply required heating.
FEATURES — Burner is a pressure atomizing type similar to a domestic oil burner, but designed for efficient combustion in the limited combustion space available. Gasoline or diesel oil which operates the engine may be used. Boiler consists of a double drum with inner and outer shell. Water is circulated and heated in the water chamber. The inside finned section is of stainless steel, bolted into place inside the boiler. Fins, besides increasing the heat absorbing area of the boiler, serve to force the hot gases to scrub the water-cooled surface while traveling towards the exhaust port. Hot gases are projected in reverse direction through the finned second pass area to the exhaust port. A safety Klixon stops the burner if a dry boiler or other cause produces temperature above 250F in the boiler. A circuit breaker safeguards against electrical overload.
OPERATION—Operation is initiated by an aquastat installed in the engine coolant circuit. An on-off switch adjacent to the driver activates the heater controls. When switch is on, the aquastat responds to the temperature of the coolant. If below the aquastat setting, the burner starts automatically, stops at a pre-set high limit, and continues starting and stopping as necessary to maintain the desired temperature. Heater shuts off and locks out on safety if ignition fails to take place or flame is lost. When the heater locks out on safety shut-down, it cannot restart until manual reset button is pushed. A switch is provided for light on instrument panel to warn the driver that the heater is shut off on safety. A warning light, or other signal, may be used to advise of any safety shut-down during parking period.
LITERATURE AVAILABLE—Illustrated folder.
MADE BY — *Petroleum Heat and Power Co., Stamford, Conn.* **34**
Exhibited at Chicago

Boiler

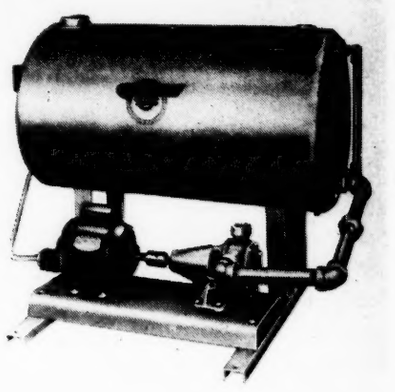
NAME—R-Z-U junior steel boiler.
PURPOSE—Space heating.
FEATURES—Unit has large combustion space and is said to be ideally suited for coal, oil or gas, and for stoker or hand firing. Cleaning and servicing are through large doors in the front of the boiler for both tubes and firebox. Unit has a large flue gas travel of the two-pass design. Provision is made for domestic hot water by a submerged copper coil which eliminates the need of a storage tank. Boiler is built in accordance with provisions of the ASME code and is rated on the basis of the Steel Boiler Institute code. Boiler is hydrostatically tested to 60 lb water



pressure, before leaving plant.
SIZES AND CAPACITIES—From 1,100 to 3,000 net sq ft steam for mechanical firing and from 910 to 2,480 net sq ft steam for hand-fired coal. Boiler is also available for hot water heating.
MADE BY—*Fitzgibbons Boiler Co., Inc., 101 Park Ave., New York 17, N. Y.* **35**
Exhibited at Chicago

Condensate Unit

NAME—Roth Type UC heavy duty condensate return units.
PURPOSE — For installations han-



dling up to 100,000 sq ft EDR and up to 150 lb operating pressure.
FEATURES — Bronze-fitted turbine type pump has sealed-in grease bearings. Special strainer with gland type connections is said to eliminate noise transfer through pipes. Shortened piping to pump suction insures against vapor binding. It is available packaged or knocked-down. Packaged construction provides tank, under rails, and base welded together. It is crated and shipped as a unit. Knocked-down unit provides pump base and motor crated, and tank shipped separately uncrated.
OPERATION—Pump is controlled by a float switch mounted on tank. Switch starts motor when water in tank reaches high level and stops motor when water reaches low level.
SIZES AND CAPACITIES—From 1,000 to 100,000 sq ft EDR and from 10 to 150 lb operating pressure. Five tank sizes from 20 to 200 gallons.
LITERATURE—Catalog section 199.
MADE BY—*Roy E. Roth Co., Rock Island, Ill.* **36**
Exhibited at Chicago

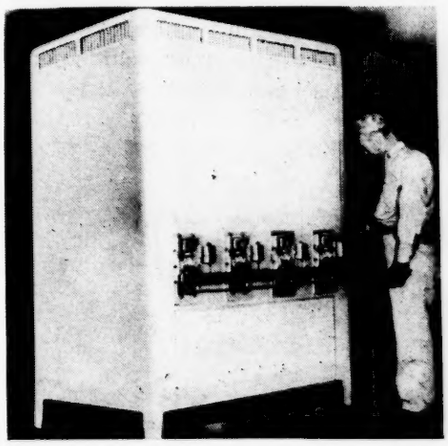
Boiler

NAME—Crane Thirty boiler.
PURPOSE—For heating buildings requiring up to 3000 sq ft of steam radiation or 4800 sq ft of hot water radiation.

FEATURES—Fire door has patented secondary air feature for close control of air over fire. Side base panel knock-out plate provides for possible future stoker installation. Insulation is attached to the sides and top of the jacket panel. Corrugated, multiple pass flue design is said to present greater area to the hot gases. Baffles are provided for controlled water travel. Boiler may be provided with trombone tank type water heater.
SIZES AND CAPACITIES—Available as hand-fired, oil-fired, or stoker-fired units in capacities from 207,000 to 720,000 Btu per hr.
MADE BY—*Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.* **37**
Exhibited at Chicago

Direct-Fired Heater

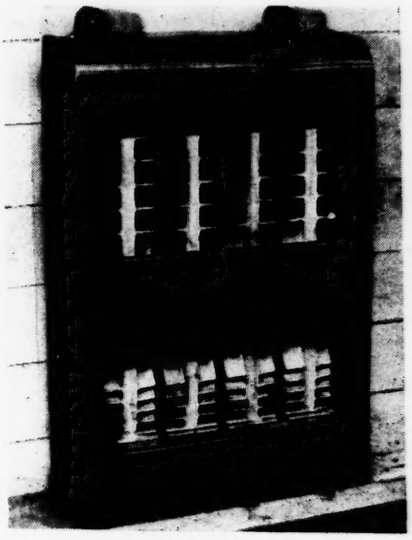
NAME—Acme direct-fired type heater.
PURPOSE—Space heating.
FEATURES—Any type of gas may be used as fuel without changing the burner. Even the largest size of this model is designed to pass through any 28-in. door. Power is transmitted from motor to fans through a V-belt, one each on the two smaller sizes and two each on the four larger sizes, situated in the base of the heater. Fan motor is single phase, open type, sleeve bearing, mounted on an adjustable base for easy belt adjustment. In the two smaller sizes, the motor is 115-volt, 60-cycle, split phase; in the four larger sizes it is 115 to 220-volt, 60-cycle, capacitor type. The air outlet located on top of the unit is provided with a self-contained plenum chamber where upward air streams on all four sides of the unit converge. Adjustable grilles are located on three sides to permit a direct delivery of air to areas being heated. Unit has a thermostat to control burner operation, pressure regulator for maintaining gas pressure, a magnetic gas valve which is also actuated by the thermostat, combination fan and limit control, and a manually operated pilotstat.
LITERATURE AVAILABLE — Bulletin 481.
SIZES AND CAPACITIES—Six sizes with output at bonnet from 88,000 to 528,000 Btu.



MADE BY — *Acme Equipment Co., Muskogee Okla.* **38**
Exhibited at Chicago

Electric Heater

NAME—Explosion-proof heater.
PURPOSE—Heater for use in areas outlined by Underwriters' Laboratories, Class 1, Group D, which includes atmospheres containing naphtha, gasoline, or other solvent vapors.
FEATURES—The safety-grid heating element used in unit consists of a nickel chromium resistor wire, insulated and sheathed in a seamless metal tubing, which is embedded in a one-piece finned aluminum casting. This is said to seal the element and to eliminate the fire danger. Grid remains at a low operating temperature and is said to have a high thermal conductivity. Heaters are furnished



complete with connection box for ¾-in. conduit. Heaters may be thermostatically controlled through a contactor.
SIZES AND CAPACITIES—Three models with ratings of 2,000, 4,000, and 6,000 watts.
MADE BY—*Electromode Corporation, 45 Crouch St., Rochester 3, N. Y.* **39**
Exhibited at Chicago

Weld Pipe

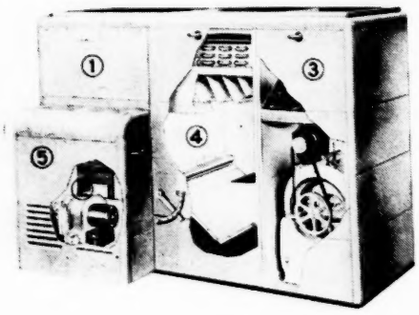
NAME—Republic continuous weld pipe.
PURPOSE—Improved weld pipe for general use.
FEATURES—Pipe is made of a continuous ribbon of skelp and the ends of coils of flat steel of proper width are then welded. The rolls leave as a continuous tube which is then sawed into proper length. Instead of making pipe one length at a time, the mill delivers uniform pipe in a continuous tube which is cut into the desired length as it leaves the welding rolls. Pipe is available in standard weight, black and galvanized and in sizes from ⅛ in. to 3 in.
LITERATURE AVAILABLE—Illustrated folder.
MADE BY—*Republic Steel Corp., Cleveland 1, Ohio.* **40**

Modular Furnace

NAME—Mueller Climatrol modular furnace.

PURPOSE—Heating plant designed to permit flexibility of installation for the home owner.

FEATURES—With this type design



the owner can obtain a basic heating package to which other units can be added at a later date. The basis of this gravity furnace can be expanded to a completely automatic winter and summer air conditioning plant. In the photograph (1) is the gravity furnace with square casing, (2) gas or oil burner, (3) forced circulation unit for filtering and humidifying warm air, (4) cooling unit with by-pass arrangement for controlling summer humidity, and (5) vestibule for enclosing burner and controls. Each of these packages may be purchased individually.

MADE BY—*L. J. Mueller Furnace Co., 2005 W. Oklahoma Ave., Milwaukee 7, Wis.* **41**

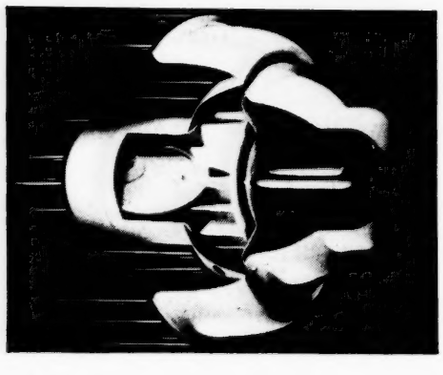
Exhibited at Chicago

Air Exhauster

NAME—Wall model type Jenn-Air exhauster.

PURPOSE — For removal of heat, smoke, or fumes.

FEATURES—Power unit consists of a continuous duty motor and direct-connected impeller. Unit is mounted on the outside wall with the duct inlet extending through to the inside. Motor is located out of the air stream so that it is free from moisture or corrosive deposits carried by the air. Annular housing, constructed of aluminum, is provided with an automatic back draft damper. Makers claim that good operating efficiencies can be maintained in both long and short duct runs regardless of weather conditions. Motor is ¼ hp operating at 1750 rpm. A centrifugal type impeller is used.



SIZES AND CAPACITIES—Inlet diameter, 8 in.; diameter of opening required, 10 in.; overall diameter, 20½ in.

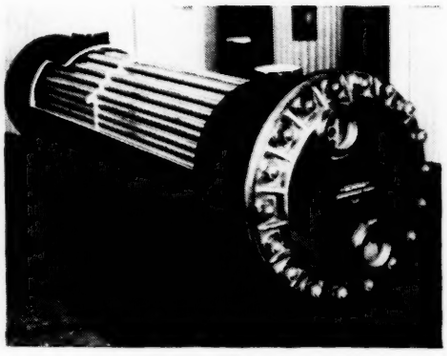
MADE BY—*Jenn Air Products Co., 409 Architects & Builders Bldg., Indianapolis, Ind.* **42**

Exhibited at Chicago

Tankless Heater

NAME—Instantaneous water heater.

PURPOSE—For industrial and apartment house installation.



FEATURES—Steam is reduced from high pressure to 15 lb or less by a steam reducing valve and the temperature control is maintained by a thermostatic mixing valve. Unit is constructed with 6-pass bronze heads and heavy wall drawn seamless copper U-bends expanded into bronze tube sheets. Coils are said to be suitable for use with water pressures up to 150 lb. Shells are made of steel for use with steam pressures up to 125 lb.

SIZES AND CAPACITIES—Model No. 624, illustrated, has a capacity of 100 gpm, heated from 40F to 140F with steam supplied at 15 lb pressure. Other sizes are available.

LITERATURE AVAILABLE—Catalog 18.

MADE BY—*General Fittings Co., 123 Georgia Ave., Providence 5, R. I.* **43**

Exhibited at Chicago

Air Filter

NAME—Trion electric air filter.

PURPOSE—Air cleaning through electrostatic means.

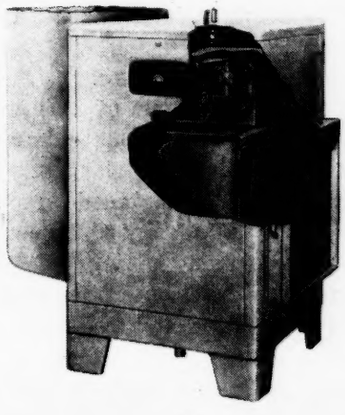
FEATURES—Three distinct functional units are housed in a steel cabinet. The ionizing collecting cell consists of fine tungsten wires suspended in front of and between a series of parallel aluminum plates on which the foreign particles from the air are collected. A power pack, with transformers and rectifier tubes, is used for supplying high voltage d-c to the ionizing collecting cell. A water wash spray system automatically takes the dirt away from the aluminum collecting plates. Makers claim that this unit will remove more than 90% of particulate matter from air streams. A built-in filter rack on the outlet side of the unit contains a glass wool filter to diffuse the air and trap any blow-off which may occur. Water and electric lines enter the top of the cabinet and the dirt-laden water drains from the bottom to the nearest sewer outlet. On the front of the cabinet are the power switch, water wash switch, and an indicating instrument.

SIZES AND CAPACITIES—Made in several models with maximum ratings of 1500 to 4000 cfm.

LITERATURE AVAILABLE—R26-48.

MADE BY—*Trion Inc., 1000 Island Ave., McKees Rocks, Pa.* **44**

Exhibited at Chicago



Boiler

NAME—Federal FD series boiler.
PURPOSE—Space heating for small commercial installations.
FEATURES — Boiler consists of

⅜ in. tube sheets and intermediate tube sheets and 5/16 in. wrapper sheets and fire box. Tubes are 3 in. expanded and bell flared. Oil-fired base is 12 in. high; stoker-fired base 16 in. high. Cleanout and fire doors are fabricated of steel and are insulated. Series is available in oil-fired, gas-fired and stoker-fired boilers.
SIZES AND CAPACITIES—Steam ratings of 1500, 1800 and 2200 square feet.
MADE BY—*Federal Boiler Co., Inc., Midland Park, N. Y.* **45**
Exhibited at Chicago

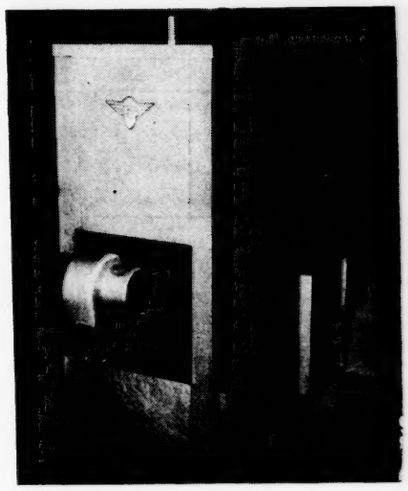
Small Furnace

NAME — Thatcher series C-174H coal-burning furnace.
PURPOSE — Space heating for the small home with coal as fuel.

FEATURES—Designed for installation in a first-floor utility room, or in a cellar. Size has been held down to 24 in. square. Blower unit is separate and may be set directly against the unit or a few feet away at the convenience of the builder. Furnace body is made of 10 gage black iron with welded construction. Ashpit bottom is of 14 gage. Unit has locomotive-type rocking and dumping grates for bituminous and anthracite coal. Other features include cast iron smoke hood with check damper and turn damper, and segment type firebrick lining. Blower unit is mounted on a sound-absorbing base. Motor is 176 hp, 110 volt, 60 cycle, single phase with automatic thermal overload protection. Blower drive operates at 1720 rpm.
SIZES AND CAPACITIES—49,000 Btu per hr at the register or 58,000 Btu per hr at the bonnet.
LITERATURE AVAILABLE—Illustrated folder.
MADE BY—*Thatcher Furnace Co., Garwood, N. J.* **46**
Exhibited at Chicago

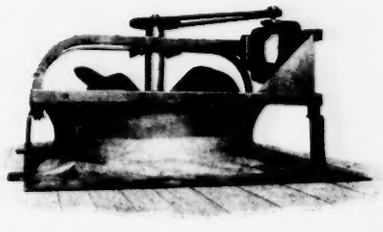
Furnace

NAME—Metropac winter air conditioner.
PURPOSE—Forced warm air heating with provisions for domestic hot water.
FEATURES—Heat is supplied by a Metromatic oil burner. A centrifugal type blower of 10 in. diameter is used to force air through the unit. Locomotive fire tube construction is used to achieve low stack temperatures. A damper is installed for by-passing the heating unit and for providing cool air in summer while water is being heated for domestic use. A 1/6 hp blower motor is used; 1/3 hp for largest size. The air delivered, which depends upon the size of unit, varies from 700 to 1,800 cfm. The water storage tank is constructed of copper to withstand a 300 lb test.
SIZES AND CAPACITIES—Three sizes available with Btu output at registers of 70, 120, and 180.
LITERATURE AVAILABLE—Illustrated folder.
MADE BY—*Metromatic Manufacturing Co., 21 Henderson St., Everett 49, Mass.* **47**
Exhibited at Chicago



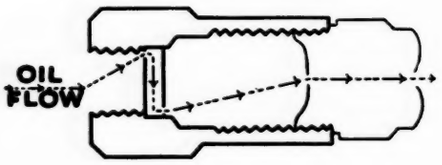
Ventilating Fan

NAME—Ventilating fan.
PURPOSE—Ventilation for home or industry.
FEATURES—Unit can be installed horizontally, vertically, or at an angle by means of a special installation kit. Included in this kit is a flexible, air-tight, fabric boot which, in the horizontal installation, is slipped over and sealed to the venturi ring, then tacked down around ceiling opening to form the suction chamber. An automatic ceiling shutter is also supplied. Motor has conduit box attached for all 110-volt applications. Unit is rubber-float mounted, with resilient isolators placed between frame and mounting brackets to prevent transmission of vibration to the structure. Fan has four blades, die cut, and die formed.
SIZES AND CAPACITIES — Available in fan sizes of 24, 30, 36, 42 and 48 in.
MADE BY—*Holcomb & Hoke Mfg. Co., Inc., Indianapolis, Ind.* **48**
Exhibited at Chicago



Nozzle

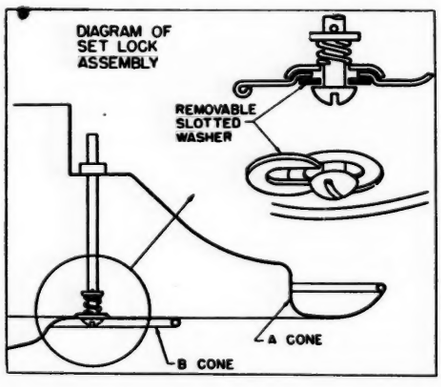
NAME—Adaptrap.
PURPOSE — Combination anti-drip device and nozzle adapter for oil burners.



FEATURES—Unit is designed to replace the conventional adapter, to permit the escape of entrapped air in the fuel line or nozzle and to prevent this air from re-entering. Unit is free from any moving parts. Makers recommend unit for use in high pressure gun type oil burners to eliminate erratic spray, and flame flutter when such trouble is caused by air in the oil line. It is also designed to correct after-drip when the burner stops.
MADE BY — *Delavan Engineering Co., Des Moines, Iowa.* 49
Exhibited at Chicago

Air Diffuser

NAME—Kno-Draft adjustable air diffuser with quick-opening set-lock assembly.
PURPOSE—Assembly which permits the entire inner element of the air diffuser to be removed or replaced in a few moments.
FEATURES—Inner element of diffuser consists of an inner cone with or without an air volume damper and it is supported and adjusted by bolts attached to the shoulder of the outer cone. The inner element fits over the combined suspension and adjustment bolts and is held in place by spring-loaded catches which are kept in compression by slotted washers that can be removed or replaced by a slight pressure on the inner cone. With the washers removed the holes in the inner cone slip over the bolt heads.
LITERATURE AVAILABLE — Bulletin K-21.
MADE BY—*W. B. Connor Engineering Corp., 114 E. 32nd St., New York 16, N. Y.* 50
Exhibited at Chicago



Water Heater

NAME—AquaHeater.
PURPOSE—For supplying domestic hot water.
FEATURES—Rocklining is applied to the inside of a steel jacket to prevent galvanic action and corrosion. Pre-cut asbestos insulating jacket is available if desired. Heater consists of a welded steel shell and copper coil. Heater is guaranteed for 15 years.

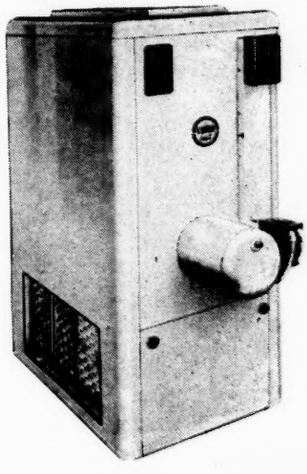
SIZES AND CAPACITIES—3½ gpm.
MADE BY—*Joseph E. Lewis & Co., Inc., 1303 Carroll St., Baltimore 30, Md.* 51
Exhibited at Chicago

Industrial Fan

NAME—Silentvane fan.
PURPOSE—Centrifugal fan for industrial ventilation.
FEATURES — Fan has back-tilted blades to change the direction of air gradually. Makers claim a static efficiency of 80% with its new design—achieved by a combination of several changes in the fan's blading, wheel, inlet, backplate, and scroll. Most significant change over previous models is the design of the new fan's scroll, the spiral housing that surrounds the revolving blades. This housing was modified so that it is steeper where close to the wheel to permit greater uniformity. The resulting closer conformity to the natural air flow is said to be the chief cause for improved performance.
SIZES AND CAPACITIES—Available in 23 sizes with wheels ranging from 1 to 9 ft in diameter. The largest model stands nearly 18 ft high and is capable of moving 480,000 cfm.
MADE BY—*Westinghouse Electric Corp., Pittsburgh 30, Pa.* 52
Exhibited at Chicago

Furnace

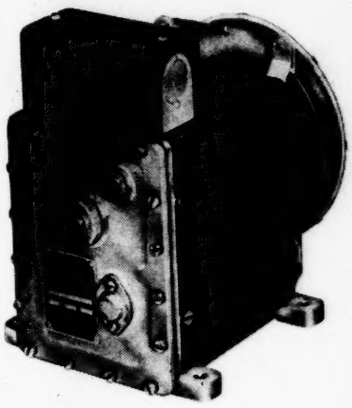
NAME—Conco VF oil-fired winter air conditioner.
PURPOSE—Space heating.
FEATURES—Unit has removable air filters. The motor is so placed that it is cooled by the incoming air. A long flue gas travel is said to reduce chimney heat loss. Controls are factory installed and include an automatic humidifier. Although the oil-fired model is illustrated, a gas-fired unit is also available.
MADE BY — *Conco Engineering Works, Mendota, Ill.* 53



Modutrol Motor

NAME—M-H Series 90 modulating control motor.

PURPOSE—Motor control to be used as an electric valve operator where positive closure of the valve is de-



sired when the fan is shut down or power fails.

FEATURES—Unit has a return spring that returns the motor to its starting position upon power failure. Return spring assembly has an overcoast feature to protect the gear train from shock of sudden stops that occur when the motor has been returned to its starting position. Makers claim that the motor's 160 deg stroke is capable of providing close modulating valve control. Auxiliary potentiometers and switches for controlling accessory equipment are adaptable to the cover end of the motor shaft. Switches are of the mercury tube type.

MADE BY—*Minneapolis-Honeywell Regulator Company, Minneapolis, Minnesota.* 54

Exhibited at Chicago

Valve Disc

NAME—Cranite.

PURPOSE — Composition discs for use with disc globe, angle and check valves for both steam and hot water systems.

FEATURES—Disc is available in various compositions for various working pressures and temperatures. Each of five types is made of a specially formulated composition. Discs are molded and vulcanized under heavy compressive loads best suited for the service intended. No. 1 Cranite, intended for 150 lb saturated steam or hot water service, is made of synthetic rubber base, asbestos, and other ingredients. It is hard at room temperature and soft when heated. No. 4 disc has a base of butadine-acrylonitrile base, with fiber asbestos, and other ingredients. They are intended for steam up to 300 lb, 450F and for hot water of 600 lb pressure, 420F. No. 6 is intended for hot water up to 200F. No. 7 and 9 are smaller size discs for use in low pressure globe, angle and check valves. No. 7 is a 100 lb steam disc suitable also for hot water up to 200F. No. 9 is for cold water or domestic gas service.

SIZES AND CAPACITIES—No. 1, ½ to 6 in. inclusive; No. 4, ¼ to 3 in. inclusive; No. 7 and 9, ½ to 2 in. inclusive.

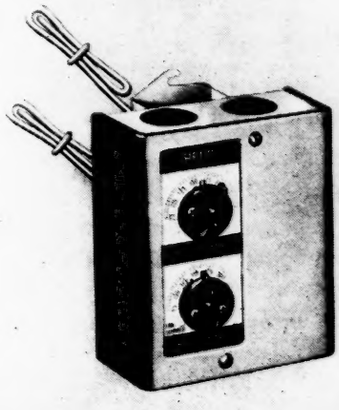
MADE BY—*Crane Company, 836 S. Michigan Ave., Chicago 5, Ill.* 55

Fan Control

NAME—Penn liquid expansion fan and limit control.

PURPOSE—Warm air furnace fan and limit control.

FEATURES — A self-compensating diaphragm structure consists of a single diaphragm made of low expansion stainless steel backed by a brass retaining cup of the same shape. The difference in the coefficient of expansion between these two metals creates enough additional space between them on a change in ambient temperature, to accommodate the expansion of the contained liquid. Only liquid expansion or contraction due to temperature changes at the bulb in the furnace bonnet can change diaphragm controls to create switch operation. A calibrated dial shows directly both cut-in and cut-out points. Once set, the differential remains constant over the entire range. A flexible capillary permits the control to be mounted at any angle or position.



LITERATURE AVAILABLE — Bulletin 2716.

MADE BY—*Penn Electric Switch Co., Goshen, Ind.* 56

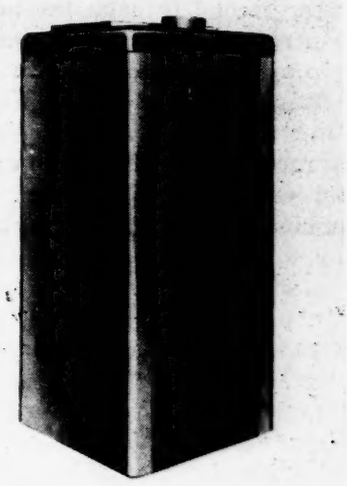
Exhibited at Chicago

Furnace

NAME—5500 Series Armstrong Hi-Boy gas-fired winter air conditioner.

PURPOSE—Space heating.

FEATURES—Back draft diverter is



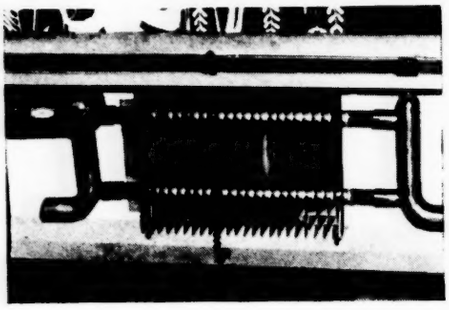
built in as part of the heat exchanger of the unit, with a flue pipe at the top. Makers claim that by combining the diverter construction with the heat exchanger, the furnace is more accessible for cleaning. Twin blowers are used to put parallel air streams up each side of the heat exchanger. Twin blower construction is said to save head room in the furnace and to reduce the normally high static pressure through the furnace. Unit is shipped assembled and crated. Furnace can be supplied for all types of gas and is AGA approved.

MADE BY — *Armstrong Furnace Company, Columbus, Ohio.* 57

Exhibited at Chicago

Baseboard Heater

NAME—Rittling baseboard heating.
PURPOSE—Space heating.
FEATURES — Unit is placed on the wall near the floor by the use of



brackets. Cover over fin coil is removable for cleaning. Either two-pipe steam or forced hot water heating systems may be used with this type unit. A damper, regulated by a front pull chain, comes in 6 ft lengths. The manufacturer recommends a water velocity of 2 ft per second through the heating element and a water temperature drop of 20F in any one circuit.
SIZES AND CAPACITIES—With a water temperature of 170F, capacity rating is 600 Btu per hr lineal foot of heater. The copper tube aluminum fin heater is furnished in 2, 3, 4, 5, 6, 7, 8 and 9 ft lengths. Top and front cover, 6 ft lengths only.
LITERATURE AVAILABLE—Illustrated folder.
MADE BY—*The Rittling Corp., 1292 Niagara St., Buffalo 13, N. Y.* 58
Exhibited at Chicago

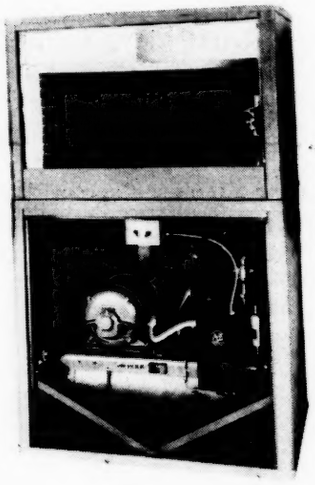
Kitchen Ventilator

NAME—Axivane kitchen exhauster.
PURPOSE—For ventilation of kitchens.
FEATURES—Unit is made in wall mounted and ceiling mounted types.

When placed on an outside wall, unit requires no additional duct work. When wall mounted, unit is provided with integral metal duct which completely encloses the fan. The ceiling type requires an additional duct to carry the exhaust air to the outside. A built-in weather hood is mounted on the outside of the building. This hood contains a set of swinging louvers which open automatically when the fan is in operation. The air outlet is screened to prevent entrance of insects. Exhauster is operated by an axivane fan.
LITERATURE AVAILABLE — Bulletin J608.
MADE BY—*Joy Manufacturing Co., Oliver Bldg., Pittsburgh 22, Pa.* **59**
Exhibited at Chicago

Air Conditioner

NAME—Curtis FWH-300-PA packaged air conditioner.
PURPOSE—Air cooling and air conditioning.
FEATURES—Unit has a large shell and coil condenser. A slow speed multivane fan, operated by a motor with built-in overload protection, is connected to the fan through a



variable drive. A slow speed compressor is used, provided with open Timken roller bearings and oil ring lubrication. If desired, a heating coil can be installed above the cooling unit. On top part of unit is a two-way adjustable outlet grille. Unit is designed to cool, dehumidify, circulate and filter the air in summer, circulate and filter the air in the spring and fall, and to heat, circulate and filter the air during the winter. Units are completely assembled at the factory and require only electrical and water connections for installation.
LITERATURE AVAILABLE — Bulletin RS-10E-8.
MADE BY — *Curtis Refrigerating Machine Div., Curtis Mfg. Co., St. Louis, Missouri.* 60
Exhibited at Chicago

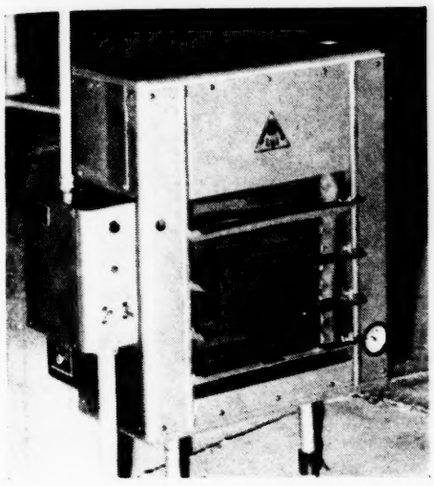
Window Ventilator

NAME—Silent Breeze window ventilator.

PURPOSE—Night cooling unit for apartments and small homes.
FEATURES—Unit fits inside any window frame measuring 27 in. and under. It extends into room only 3½ in. There are two receiving brackets that attach inside the window frame so that ventilator may be removed when windows are to be washed. Fan has four 24-in. blades. Motor is two-speed, 115 volts, 60 cycles, single phase a-c. At high speed of 650 rpm, air delivery is 4000 cfm; at the low speed of 400 rpm, it is 2450 cfm. Unit may be converted to a portable circulator by the addition of protective grille with handle grip furnished by the manufacturer.
MADE BY—*Holcomb & Hoke Mfg. Co., Inc., Indianapolis, Ind.* 61
Exhibited at Chicago

Unit Heater

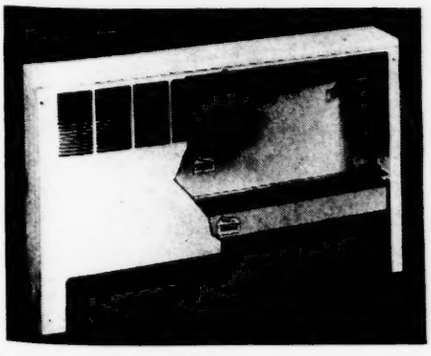
NAME — Tri-Dee electric steam heater.
PURPOSE—Space heating.
FEATURES—Electric current is used



to generate steam. A large 4-blade fan forces air over copper fin heat exchanger tubes. Heater is provided with thermostatic control to maintain a constant temperature. Adjustable louvers direct the heat to points desired. Unit is provided with a magnetic contactor switch and thermostat. A 1/25 hp fan motor is used to provide about 800 cfm.
SIZES AND CAPACITIES—Power consumption is 8 kw, operating at 230 volts. Unit delivers 27,296 Btu.
LITERATURE AVAILABLE—Illustrated folder.
MADE BY—*Dingman Distributing Co., 8333 W. Chicago Ave., Detroit 6, Mich.* **62**
Exhibited at Chicago

Convector

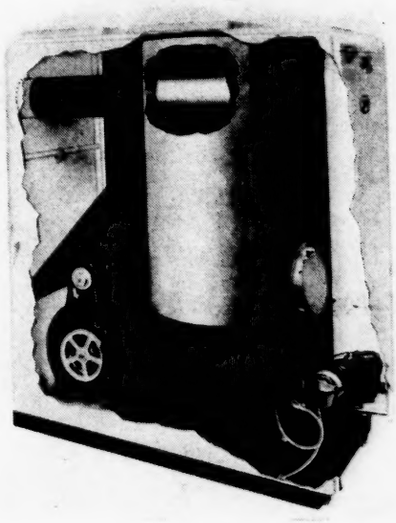
NAME—Type F convector-radiator.
PURPOSE—Space heating.
FEATURES — Unit is designed for use with steam and gravity or forced hot water systems. Fedders type F heating elements have copper and aluminum fins. Fin holes have die-formed collars to provide large heat transfer contact between tube and fin. Fins are mechanically bonded to tubes. Cast headers are arranged for convenient piping connections at either end, top or bottom. Adjusting screws permit proper pitch of element to suit installation conditions. A formed steel cabinet with removable front panel is provided although heating elements can be purchased without convector cabinet where specially designed concealed radiation is specified.



SIZES AND CAPACITIES—Available in standard 4-, 6-, 8- and 10-in. widths and in lengths up to 64 in.
LITERATURE AVAILABLE—Catalog.
MADE BY — *Fedders-Quigan Corp., Buffalo 7, N. Y.* **63**

Two-Fuel Furnace

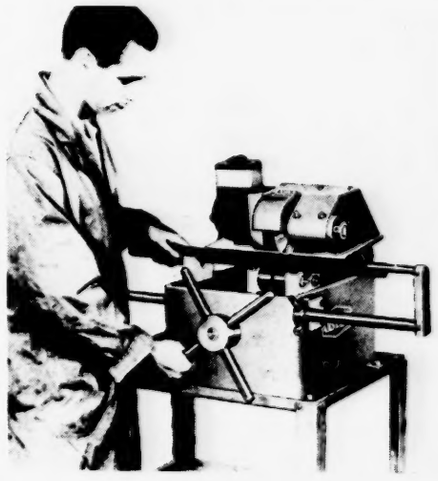
NAME—Richmond two-fuel winter air conditioner.



PURPOSE — For residential space heating and humidification.
FEATURES — Warm air furnace is designed for and is sold equipped with either a gas burner or an oil burner. Changeover from one fuel to the other is made by interchanging burner units, mounting plates, and fuel connections. Standard equipment includes thermostat, draft regulator for oil or draft hood for gas. Humidifier and float control are optional. Vaporizing oil burner is used for small units, pressure atomizing oil burner is used with larger units. Heat exchanger and economizer are 12 or 16 gage steel. Blower motor is 1/6 hp on small model (AS-12) and 1/4 hp on larger model (AS-23). Jacket is white enameled steel. Featured are spun glass replaceable filters, adjustable blower speed, centrifugal blower.
SIZES AND CAPACITIES — Model AS-12G for gas, 72,000 Btu per hr output at bonnet. Model AS-12V for No. 1 oil at 3/4 gpm, 75,000 Btu per hr at bonnet. AS-23G, gas, 92,000 Btu per hr at bonnet. AS-23P, No. 3 oil, at 1 gph, 106,000 Btu per hr at bonnet.
MADE BY—*Richmond Radiator Co., 19 E. 47th St., New York 17* **64**
Exhibited at Chicago.

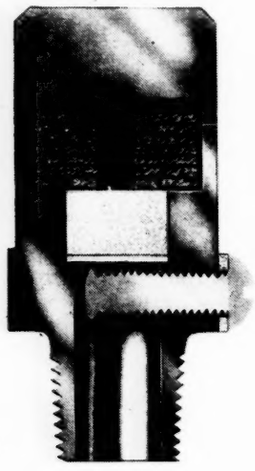
Pipe Cutter

NAME—Oster No. 662 Cut Master.
PURPOSE — Machine for cutting small or large quantities of pipe within the range of ½ to 2 in. pipe diameters inclusive.
FEATURES—Unit is operated by a ½-hp motor of variable speed and a gear ratio of 29.25 to 1. Motor, idler shaft, and cutter shaft are mounted as a unit on a plate hinged to the base casting. Rollers supporting the pipe to be cut off are mounted on needle bearings. Rollers are grooved to prevent breakage of cutter wheel which is ground to reduce to a minimum the burr on the pipe. Machine weighs 225 lb.
MADE BY—*The Oster Manufacturing Co., 2057 E. 61st St., Cleveland 3, Ohio.* **65**



Automatic Air Valve

NAME—Taco-Vent.
PURPOSE — Automatic venting air valve for hot water heating systems.
FEATURES—Air passes through spe-



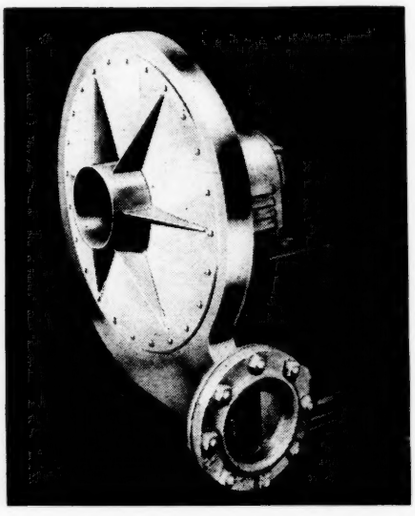
cial filter, porous bronze plug, special fiber discs and vent holes through which air is released to atmosphere. Vent is provided with ⅛ in. connection.
OPERATION—Water, which follows the air, is cleaned of all foreign matter by the special filter and is then slowed up as it passes through the porous bronze plug. When the water reaches the fiber discs it causes the discs to swell, thereby sealing the valve. As more air accumulates the fiber discs dry and shrink, thus enabling the valve to vent again, and this operation is repeated.
LITERATURE AVAILABLE—Folder.
MADE BY—*Taco Heaters, Inc., 137 South St., Providence 3, R. I.* 66
Exhibited at Chicago

Gas Valve

NAME — White-Rodgers 4-in. diaphragm gas valve.
PURPOSE—Control of gas flow.
FEATURES — Valves have the same length dimensions as solenoid valves of the same pipe size so that it is suitable for replacement service where the user prefers the smooth and quiet operation resulting from diaphragm valves. Unit is available with or without manual reset and the manual reset feature recycles automatically, going back on automatic operation on resumption of electric power. Valve may be used for natural, manufactured or mixed gas and is provided with a ⅛ in. tapping for a by-pass or pilot connection. Valve operates on 24 volts; other voltages are available.
SIZES AND CAPACITIES—½ and ¾ pipe sizes.
LITERATURE AVAILABLE—Folder.
MADE BY—*White-Rodgers Electric Co., 1209 Cass Ave., St. Louis 6, Mo.* 67
Exhibited at Chicago

Blower

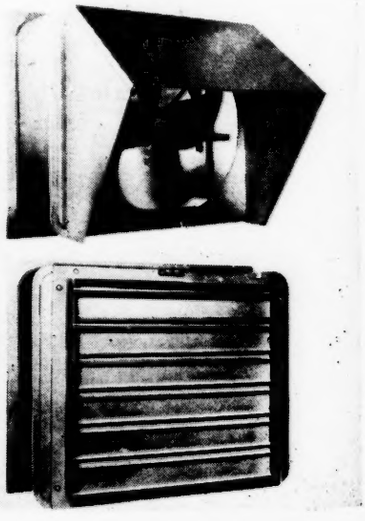
NAME — Chicago turbo pressure blower.
PURPOSE—To supply air at pressures suitable for use with oil and gas burners on industrial burners and for providing air curtains.



FEATURES — Fans are of heavy welded plate steel construction and can be supplied in ¼ to 50 hp size to deliver from 80 to 5,500 cfm at pressures from 4 to 32 oz. Blowers are available in both belt and direct driven types. Bases in housings are welded steel construction. Specially designed inlets are said to minimize the shock loss and to reduce noise.
MADE BY—*Chicago Blower Corp., 4558 West Congress St., Chicago 24, Ill.* 68
Exhibited at Chicago

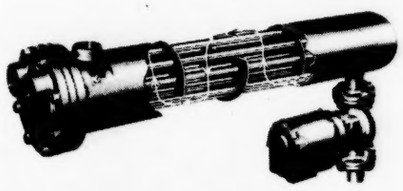
Outside Window Fan

NAME—Type AP package unit outside window fan.
PURPOSE—For ventilation in home and offices.
FEATURES—Unit, which may also be used in buildings where there is insufficient attic space for other types of ventilation, is belt driven. Fan has a 1½ in. mounting flange on all four sides. Hood extends 15¾ in. and a shutter 4 in. beyond the fan. Motor is ¼ hp and fan capacity, depending on size of unit, varies from 4500 to 8200 cfm.
SIZES AND CAPACITIES — Model AP24 with 24-in. fan and capacity of 4500 cfm; AP30 with 30-in. fan and capacity of 6500 cfm, and AP30H, 30-in. fan and capacity of 8200 cfm.
LITERATURE AVAILABLE—Folder.
MADE BY—*Chelsea Fan & Blower Co., Inc., 1206 Grove St., Irvington 11, N. J.* 69
Exhibited at Chicago



Tankless Heater

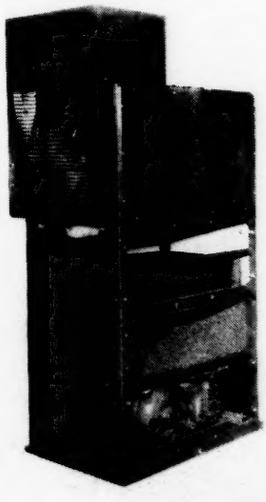
NAME—B & G type WU instantaneous water heater.
PURPOSE — To provide a tankless heater system for supplying domestic hot water.



FEATURES — A B & G booster is provided to pump boiler water through the heater shell to increase the capacity of the heater. A hot water control, installed in the hot service water supply line, starts the booster whenever water temperature goes below the desired degree. The booster pumps boiler water through the shell of the heater until service water is again at the correct temperature, and the pump is then stopped by the control. The working pressure is 125 lb per sq in. for the shell and tube side.
LITERATURE AVAILABLE — Bulletin WU-645.
MADE BY—*Bell & Gossett Co., Morton Grove, Ill.* **70**

Air Conditioner

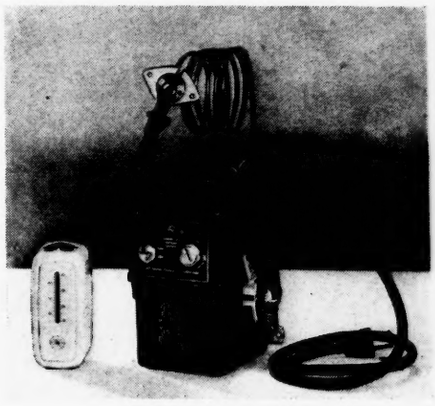
NAME — Worthington RCY - 200 packaged air conditioner.
PURPOSE — Year-round air conditioning for installations remote from space to be conditioned.



FEATURES — Sectional construction is used to permit easy handling, interchangeability and flexibility in assembly. Worthington compressor employs splash lubrication and is driven by a 7½ hp high torque low starting current motor. Condenser is of the water cooled shell and tube type with finned copper tubes and removable water heads. Unit is provided with either 4 or 8 passes, and is available less shell and tube condenser if desired for use with an evaporative condenser. Forward curved centrifugal fans, dynamically balanced, are used. If desired, unit can be provided with fans and by-pass dampers for accurate control of recirculated and outside air. All steel parts are bonderized and covered with a corrosive resistant enamel. Parts normally exposed to moisture are fabricated from zinc coated steel.
SIZES AND CAPACITIES—At standard ASRE conditions, capacity is 95,300 Btu per hr.
MADE BY—*Worthington Pump and Machinery Corporation, Holyoke, Mass.* **71**
Exhibited at Chicago

Heat Regulating Set

NAME—Model 110-A Comfort Master Heat regulating set.
PURPOSE—A system of heating control for boilers or furnaces burning solid fuel.
FEATURES—Only two electrical connections are required—one of the plug-in type from the power unit, and the other a low voltage connection between thermostat and motor regulator. The self-oiling hydraulic-action motor is completely submerged in oil for long life. A thermo-bulb limit control, adaptable to either warm air or hot water installations, prevents furnace from overheating. In the event of power failure, dampers will return to check position. A built-in transformer supplies the low voltage. A stoke switch automatically opens draft when firing to permit gases to burn off and automatically returns to thermostatic control after a five-minute interval. There is a blower fan switch for use with buckwheat coal. This assures proper sequence of operation for dampers and blower. The entire unit is completely packaged even to the smallest part.



MADE BY—*Automatic Products Co., 2450 N. 32nd St., Milwaukee 10, Wis.* **72**

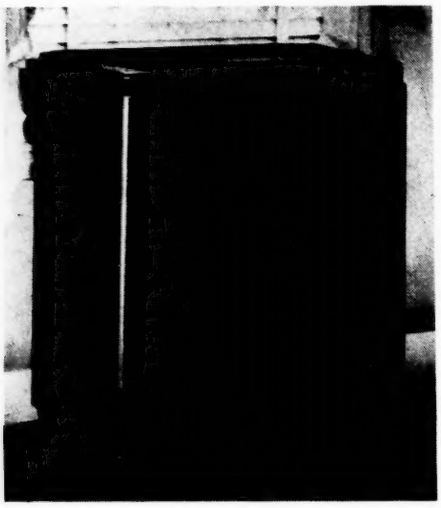
Steam Trap

NAME—Super-Silvertop steam trap.
PURPOSE — Small trap for the removal of condensate from steam lines.
FEATURES—Trap is installed either

as an elbow or straight in line. It has a blow-down plug and test plug and is said to be satisfactory for pressures up to 150 lb. Trap is said to be suitable for use on sterilizers, laundry and dry cleaning presses.
MADE BY — *The V. D. Anderson Co., 1935 W. 96th St., Cleveland 2, Ohio.* **73**
Exhibited at Chicago

Air Conditioner

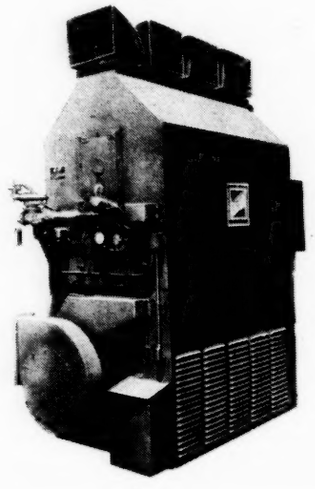
NAME—Carrier console type room air conditioner.
PURPOSE—Room cooling.
FEATURES—Unit has a special exhaust control for the quick removal of stale air and smoke and a two-speed fan for draftless air distribution. Compressor and motor are hermetically sealed. Since the compressor starts unloaded, lower starting current is required. Control panel has two knobs, one to turn on the fan only for the complete air conditioning system, and the other a selector which controls fan operation at high or low speed or for reverse operation to exhaust smoke or odors from the room. Unit operates on 230 or 208-volt, single phase 60-cycle current. Special models are available for operation on 115-volt d.-c.



SIZES AND CAPACITIES—1 hp with cabinet dimensions of 40 in. high, 34 in. wide, and 21 in. deep.
MADE BY—*Carrier Corp., Syracuse, N. Y.* 74

Space Heater

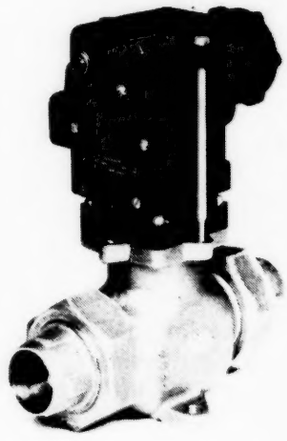
NAME—Dravo combination heater.
PURPOSE — Direct-fired warm air space heater with combination burners to function with two different types of fuel.
FEATURES—To meet situations presented by fuel shortages, combination burner was developed for converting from gas to fuel oil, or vice versa, in about 10 min. Either a light oil burner or a heavy oil burner is provided. Switching from one fuel to another requires interchanging the burners in the firing tube, connecting the proper fuel line, attaching wires for ignition system, and setting the fuel selector switch. Gas burner is of the low pressure type equipped with pilot and flame rod assembly, and gas pressure regulator. The oil burner, either of the low air pressure atomizing type or high oil pressure type, is provided with nozzles, electrodes, motor-driven pump assembly, oil pressure regulator, and oil strainer. Gas burner connection varies from 1½ in. to 3 in., depending on the model and type of gas used, while the oil line connection to the heater is ½ in. Unit is provided with a stainless steel combustion chamber which also eliminates the need for refractory lining, and is said to result in faster flame-to-air heat transfer.
SIZES AND CAPACITIES—Available in heat output capacities from 400,000 to 2,000,000 Btu per hr.



MADE BY—*Dravo Corporation, 5th and Liberty Ave., Pittsburgh 22, Pa.* 75

Valve

NAME—M-H motorized valve.
PURPOSE—Motorized steam or Freon valve for use on transportation equipment.
FEATURES—Valve includes vee ports and a reversing and positioning motor designed to decrease the possibility of sticking. Unit can be used for either modulating or on-off service. In the event of electrical failure the valve will remain in a balanced position as it does not have a spring return. Valve



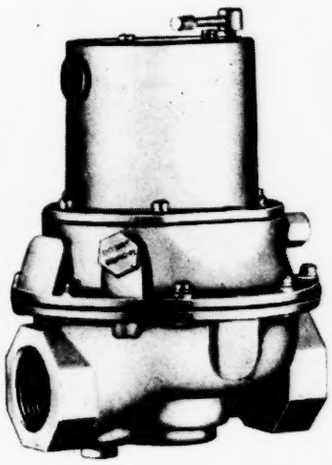
can be operated by motors using 32, 64, or 115-volt d.c. and 115-volt 60-cycle a.c. Unit includes union connections for 1 in. iron pipe size. Vee ports are available to handle 38, 55, and 95 lb of steam per hr at 5 lb pressure.
MADE BY—*Minneapolis-Honeywell Regulator Company, Minneapolis, Minnesota.* 76

Insulation Board

NAME—Air-O-Cel.
PURPOSE—Reflective thermal insulation board with a vapor barrier.
FEATURES—Insulation board is an asphalt saturated, corrugated board of the wood fiber base type, with a sheet of heavy, reflective mineralized surface laminated to its face. There is a solid and unbroken film of asphalt between this board and the laminated reflective surface. When installed between studs, joists or rafters, it forms an air-tight pocket of motionless air.
SIZES AND CAPACITIES—Available in flanged and slotted sheets 17 x 51 in. and 25 x 51 in.; in flat sheets 36 x 48 in.
LITERATURE AVAILABLE—Illustrated folder.
MADE BY — *Air-O-Cel Company, 2200 Woodward, Detroit 20* 77

Gas Valve

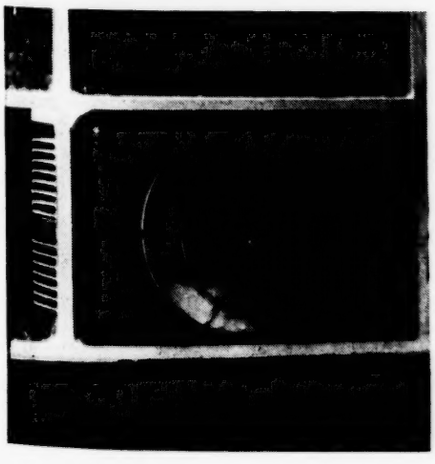
NAME — B-50 electric diaphragm gas valve.
PURPOSE—For the control of gas to space and unit heaters or furnaces and boilers.



FEATURES—Valve does not have packing glands or bellows. All body parts are die formed aluminum. Current consumption for operation is 5 watts.
SIZES AND CAPACITIES—Sizes from ⅜ in. to 1½ in. with diameters from 2¾ in. to 5¼ in. Available in seven sizes.
MADE BY—*General Controls Co., 801 Allen Avenue, Glendale 1, Calif.* 78

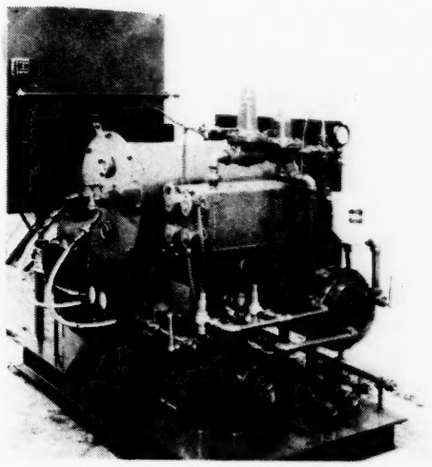
Evaporative Cooler

NAME — Sno-Breeze Junior evaporative cooler.
PURPOSE—Room cooler.
FEATURES — A quiet, heavy duty, rubber mounted motor drives a four-blade fan to expel the cooled air through a 10-in. grille covered opening. A special water distribution system is used to filter, wash and cool the air. The size and weight of the unit permits installation in most window openings and it is claimed that the unit will fit the average size casement window opening by removing one pane of glass.
SIZES AND CAPACITIES—Height, 12 in., width, 16 in., and depth, 9½ in. Weight is 17 lb.
MADE BY—*Palmer Manufacturing Corp., Phoenix, Ariz.* 79



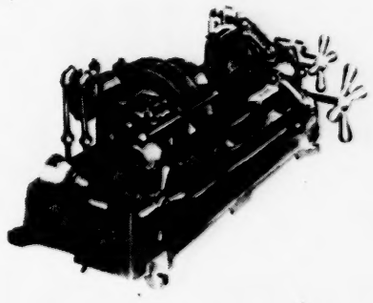
Oil Burner

NAME — Peabody automatic oil burner.
PURPOSE — A complete oil burning system for operation with all type boilers and furnaces.
FEATURES — Burner takes heavy Bunker C or lighter fuel oil, pumps it to the required pressure, preheats it and then delivers it to the burner where the oil is ignited by operating demands. Entire assembly is mounted on a common base so that there is no extra field wiring, piping or construction necessary to place this unit in operation, other than to bolt the unit to the furnace front and make the necessary service connections. An electric eye flame-failure control safeguards against flame failure. Unit has positive oil temperature control, dual gas-electric ignition, and constant differential system. The burner body receives the air for combustion from the forced draft fan and by means of the internal construction distributes it in an even stream through the air diffuser to the burner throat where it mixes with the finely atomized oil spray. Burner throat chamber is flange-mounted on the boiler front steel casing. For cold starting, electric oil heaters are installed in a specially designed reservoir and jacket. The heater unit is connected into the piping system of the burner after and in series with the steam service heater. A high pressure diaphragm type fuel oil pressure regulating valve is installed in the oil piping system to maintain a constant oil pressure at the differential valve inlet. A gas-electric ignition system for lighting the oil spray is supplied.
LITERATURE AVAILABLE—Illustrated folder.
MADE BY — *Peabody Engineering Corp., 580 Fifth Ave., New York 19, N. Y.* 80



Pipe Threading Machine

NAME—Model B portable pipe and bolt threading machine.
PURPOSE—For threading ⅛ to 2-in. pipe and ¼ to 1½-in. bolts by means of a power unit.
FEATURES—Unit has an automatic switch lock and a check wrench holder. The eccentric spool pipe-steady absorbs the whip of long lengths of revolving pipe. A gear driven oil pump provides a flow of coolant to the die. Motor is provided with a reversible switch and all gears on the unit are enclosed. A total of 186 different kinds and sizes of dies are available.
MADE BY—*Beaver Pipe Tools, 1001 Dana Ave., Warren, Ohio.* 81



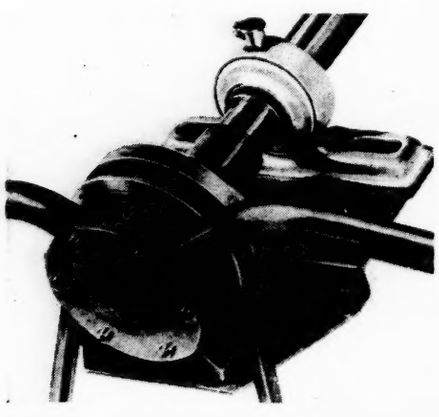
Convector-Radiator

NAME—Young convector-radiator, Type F.
PURPOSE—Space heating.
FEATURES—Damper is regulated by a pull on a chain control. Front

panel can be removed by manipulating two screws so that heating core cleaning is facilitated. A nonferrous metal core is used to facilitate rapid response to thermostatic controls.
LITERATURE AVAILABLE — Form 4048.
MADE BY—*Young Radiator Company, Racine, Wis.* 82

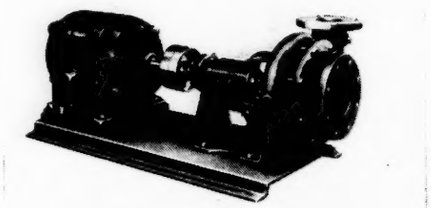
Cooler Pump

NAME — Model 1089 evaporative cooler pump.
PURPOSE—Pump for operation with evaporative coolers for air conditioning use.
FEATURES—Pump provided with a rubber impeller is driven by the fan motor. For coolers of less than 7000 cfm, the pump is coupled direct to the blower shaft, moving the pillow block just enough to provide coupling room. Pump is attached to the blower shaft by an adaptor coupling. For coolers of more than 7000 cfm, pump is belt driven from a sheave installed on the blower shaft. The self-cleansing wiping action of the impeller is said to prevent mineral precipitation.
SIZES AND CAPACITIES—Port size, $^3/_8$ in. Capacity range from 65 gph at 500 rpm to 240 gph at 1750 rpm.
MADE BY—*Jabsco Pump Co., 2291 N. Lincoln, Burbank, Calif.* 83



Centrifugal Pump

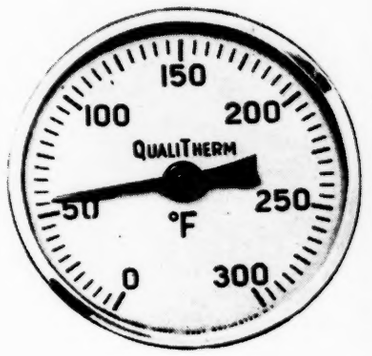
NAME—Goulds centrifugal pump.
PURPOSE—For pumping clear liquids.
FEATURES—Four different support heads enable suppliers to take care of various operations. Casing is of the volute type, bolted to support head, with recessed lock fit to insure alignment. Discharge nozzle can be swivelled to any one of four positions. No stud or bolt holes are tapped through casing into liquid passages. All impellers are statically balanced. All pumps are built in right-hand construction. A stuffing box, cast integral with the casing, is provided.



SIZES AND CAPACITIES — Fourteen sizes for both motor and belt drives. Capacities range from 10 to 1,800 gpm, with heads up to 120 ft. Available in standard fitted and all iron construction.
LITERATURE AVAILABLE — Bulletin 622-A-2.
MADE BY — *Goulds Pumps, Inc., Seneca Falls, N. Y.* 84

Thermometer

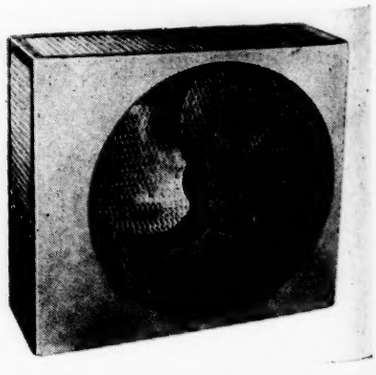
NAME—Qualitherm thermometer.
PURPOSE — Temperature measurement.
FEATURES — Pointer indications on dial thermometer may be read from any position due to the concave dials which are curved at the indicating graduations. Connecting nut and stainless steel stem are designed to withstand high pressures. Case is hermetically sealed, and pointer is said to be free of oscillation under extreme vibration conditions.



SIZES AND CAPACITIES—Dial sizes are 2, 3, and 5 in., with 7 temperature ranges from —90 to 1000F.
LITERATURE AVAILABLE — Bulletin No. 100.
MADE BY — *Qualitrol Corp., East Rochester, N. Y.* 85

Window Fan

NAME—Koolmaster window fan.
PURPOSE—For cooling and ventilation.
FEATURES—Unit is belt driven and is operated by a 1/6 hp, 110 volt, 60-cycle, two-speed standard G-E motor. Maximum motor speed is 650 rpm. Fan, said to be free of radio interference, provides 4700 cfm. Unit measures 10½ in. wide, 25¼ in. high, and is 28 in. long.
MADE BY — *Air Equipment Company, 1713 W. Carroll Avenue, Chicago, Ill.* 86



Demineralizer

NAME—The Ionex industrial water demineralizer.

PURPOSE—To convert tap water to the chemical equivalent of distilled water.

FEATURES—Dissolved mineral salts in the water are removed by a simple chemical action. Water passes through beds of ion-exchange resins. Depending upon the hardness of the raw water and the volume required, these units are available in a variety of sizes and models. One unit delivers about 5 gph. Larger units, in two- and four-bed models, are available for capacities up to 1,000 gph.

MADE BY—*Industrial Filter & Pump Mfg. Co., 1621 W. Carroll Ave., Chicago 12, Ill.* **87**

Motor Starter

NAME—Trumbull magnetic motor starter and motor contactor.

PURPOSE—For the protection of alternating-current motors up to 50 hp, 440 volts.

FEATURES—Bi-metallic relay heaters are said to be able to accurately follow the heating curve of the motor. Relay can adjust for automatic or manual reset by moving a lever. A self-lubricating composition is impregnated into the unit to keep the magnet guides sliding smoothly and to eliminate low-voltage chatter. Plastic-encased coils are provided to protect windings from moisture and abrasion.

LITERATURE AVAILABLE—Bulletin TEC-11.

MADE BY—*Trumbull Electric Mfg. Co., Plainville, Conn.* **88**

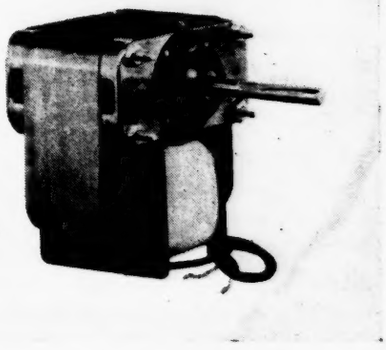
Motor

NAME—Shaded pole motor.

PURPOSE—For small horsepower applications.

FEATURES—Skeleton motor is mounted on a 3½ in. square frame lamination. Makers claim efficiencies up to 35% and starting torques up to 60%. Motor capacity is from 1/25 to 1/10 hp at 3,000 rpm. Motor is also available with gear reducers.

MADE BY—*Russell Electric Co., Div. of Raytheon Mfg. Co., 340 W. Huron St., Chicago 10, Ill.* **89**



Gage

NAME—Hydrodial.

PURPOSE—Hydraulic dial gage.

FEATURES—Gage employs an adaptation of the direct action principle of the company's standard gage. This eliminates delicate parts of the mechanism so that the unit, it is claimed, can withstand surging and pounding pressures. It incorporates many of the standard parts of Schrader gages.

SIZES AND CAPACITIES—Made in nine pressure ranges, from 5-50 lb to a maximum of 500-5,000 lb. Outside diameter of gage, 6¼ in. Overall length, 10¾ in.

MADE BY—*A. Schrader's Son, 470 Vanderbilt Avenue, Brooklyn 17, N. Y.* **90**

FEBRUARY, 1949

TO OBTAIN FURTHER INFORMATION ON NEW EQUIPMENT

On the list below, circle the item number of the equipment in which you are interested, using the number found at the end of each item.

26	27	28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45	46	47
48	49	50	51	52	53	54	55	56	57	58
59	60	61	62	63	64	65	66	67	68	69
70	71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90	

Print your name and address, detach and mail to Editor, HEATING AND VENTILATING, 148 Lafayette St., New York 13, N. Y.

Name.....

Title (Must be shown).....

Firm (Must be shown).....

(For prompt service, title and firm name must be shown above.)

Business Address.....

City.....**Zone**....**State**.....**2/49**

Abstracts and Reviews

Publications abstracted in this department should be ordered direct from publisher.

DESIGN FOR WELDING

Abstracts of 82 award papers in the recent Design-for-Progress award program of the James F. Lincoln Arc Welding Foundation are presented in book form as a record of the progress of arc welding. The papers were selected and edited by Prof. R. S. Green, acting chairman of the Department of Welding Engineering, Ohio State University.

Of particular value is the liberal presentation of cost data on the various designs for making a comparative study of methods.

Papers are grouped in the divisions of aircraft, automotive, railroad, water craft, containers, furniture, structures, machinery and welderies.

Design for Welding, edited by Robert S. Green. Semi-flexible simulated leather binding, 6 x 9 in., 1024 pages. Published by The James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio. Price, $2.

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STANDARD REVISION — Simplified Practice Recommendation R8-47 has been announced by the National Bureau of Standards to cover ferrous range boilers, expansion tanks, and solar tanks. The proposed revision has been approved by the Standing Committee and is now being distributed to all interested for their comments or acceptance. The proposed revision would add 18- and 24-gallon painted horizontal expansion tanks to the list for stock production to accommodate such heating systems that may require these size tanks. For a copy, write Commodity Standards Division, National Bureau of Standards, Washington 25, D. C.

FIRE SAFETY—A pamphlet has been issued by the National Board of Fire Underwriters which outlines safety standards for the installation of heat producing appliances, air conditioning systems and similar equipment. Provisions of this standard are not dependent upon a municipality adopting the National Building Code. Title of pamphlet is Building Code Standards of the National Board of Fire Underwriters for the Installation of Heat Producing Appliances, Heating, Ventilating, Air Conditioning, Blower and Exhaust Systems. For a copy write to the National Board of Fire Underwriters, 85 John St., New York 7.

AMINE VOLATILITY AND ALKALINITY IN RELATION TO CORROSION CONTROL IN STEAM HEATING SYSTEMS —Corrosion tests were run to compare the usefulness of several amines for the treatment of steam systems to prevent returning condensate corrosion. These tests by A. A. Berk and J. Nigon also include studies on the corrosiveness of condensate from untreated steam of low and high carbon dioxide content. Conclusions apply to a plant that was operated at 60 lb steam pressure and had a deaerating heater operated at 215 to 220F. Technical paper 714, price 20 cents. Superintendent of Documents, Government Printing Office, Washington 25, D. C.

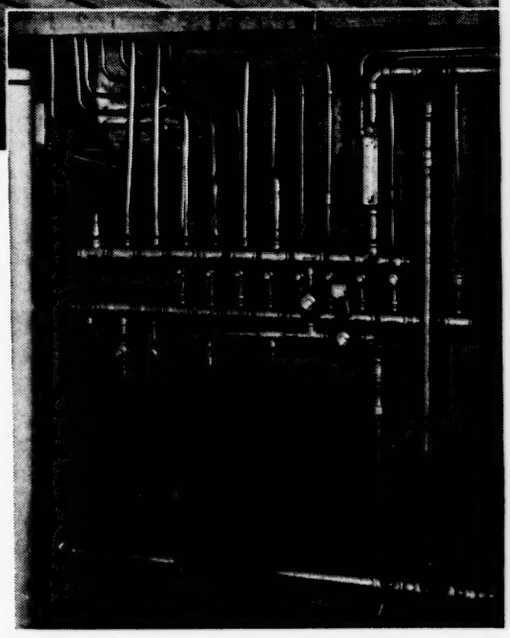
RESIDENTIAL HEAT PUMP IN NEW ENGLAND—This 48-page booklet reports experimental results obtained from an experimental direct-expansion shallow ground coil heat pump system using Freon-12 as the circulating fluid. Major emphasis is placed on the determination of the heat absorption rate of the buried tubes and the major factors that effect the heat absorption rate. Attention is given to the more important properties of the soil that affects the problem. Study was sponsored by the Connecticut Light and Power Co., with work preferred at the University of Connecticut. Price of report, 50 cents. Write to Edison Electric Institute, 420 Lexington Ave., New York 17, N. Y.

MECHANICAL COAL AND ASH HANDLING—Operators of small boiler plants are shown how they can cut costs and achieve efficient and clean plant operation by using modern mechanical methods of handling coal and ash. This report, based upon a recent study at Battelle Memorial Institute, sponsored by Bituminous Coal Research, covers plants of 30, 90, 150, 225 and 300 hp. Price, 40 cents. Bituminous Coal Research, Inc., 912 Oliver Bldg., Pittsburgh 22, Pa.

EFFECT OF COAL SIZE UPON COMBUSTION CHARACTERISTICS.—Part 3 of a study (Report of Investigation—No. 133) being made by the Illinois State Geological Survey on the combustion characteristics of domestic stoker coals. This study was limited to four representative coals from Vermilion, Franklin, Madison and LaSalle counties. Booklet of 47 pages describes the tests employed and the results obtained. Findings are largely presented in tabular form. Illinois State Geological Survey, Urbana, Ill.

WHAT GOOD ARE STANDARDS?—The American Standards Association has issued a pamphlet that contains a group of papers on the subject of What Good Are Standards? These papers were presented at the 1948 annual meeting of the association and include discussions on the legality of standardization; functions of standardization in company operations such as purchasing, manufacturing and marketing; importance of standardization to manufacturers, wholesalers, retailers and the consumer. The individual papers were written by outstanding company executives and government officials. For nonmembers, price per copy, $1; to members, 75 cents per copy. American Standards Association, 70 E. 45th St., New York 17, N. Y.

YOU DO YOUR BEST WORK WITH REVERE COPPER WATER TUBE



This beautiful and efficient radiant panel heating system is in the Revere Quality House in Seattle, Washington. Revere Copper Water Tube was used exclusively. Installed by Johnson Plumbing Co., Seattle.

FROM the beginning of the installation throughout a lifetime of continuous service, Revere Copper Water Tube is ideal for radiant panel heating.

Revere Copper Water Tube speeds installation because the 60-foot coils eliminate many joints. Where joints are needed, they are quickly made with solder type fittings. You can bend this tube readily by hand, using simple wood templates to provide the proper radius and spacing. And you can handle it easily because of its relatively light weight.

In radiant panel heating, just as in water supply and other types of heating systems, *trouble always costs more than Revere Copper Water Tube.* The permanently smooth interior of this tube reduces frictional resistance to a minimum. It is highly resistant to corrosion attack from water in the heating system; hence rust accumulation is eliminated. And the coefficient of expansion of Revere Copper Water Tube is almost identical with that of plaster, which is an important advantage in wall and ceiling installations.

It will also pay you to install such other long-lived Revere materials as Red-Brass Pipe; Sheet Copper and Herculoy for tanks, ducts, pans and trays; Dryseal Copper Refrigeration Tube (dehydrated and sealed); Copper oil burner, heat control and capillary tubes.

Revere materials are handled by Revere Distributors in all parts of the country. The Revere Technical Advisory Service is always ready to serve you. Call your Revere Distributor.

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COPPER AND BRASS INCORPORATED

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DEGREE-DAYS FOR DECEMBER, 1948

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city.

HEATING AND VENTILATING's 21st Year of Publication of Monthly Degree-Day Data

City	December			Cumulative, Sept. 1 to Dec. 31			Heating Season[1]
	1948	1947	Normal	1948	1947	Normal	Normal
Abilene, Texas (A)	462	546	592	950	546	925	2061
Albany, New York (A)	1111	1316	1147	2354	2644	2439	6580
Albuquerque, New Mexico (A)	836	942	630	1893	1848	1827	4298
Alpena, Michigan (C)	1142	1199	1247	2522	2641	2951	8299*
Anaconda, Montana (C)	1467	1161	1238	3466	3187	3171	8357**
Asheville, North Carolina (C)	710	761	576	1509	1569	1689	4232
Atlanta, Georgia (A)	532	570	639	1006	1118	1131	2890
Atlantic City, New Jersey (C)	753	897	893	1436	1655	1735	5176
Augusta, Georgia (C)	415	527	549	712	928	886	2161
Baker, Oregon (C)	1394	1101	1156	3159	2708	2815	7163
Baltimore, Maryland (C)	751	865	874	1407	1595	1664	4533
Billings, Montana (A)	1385	1146	1194	2817	2764	2816	7119
Binghamton, New York (C)	(a)	1156	1156	(a)	2368	2515	6808
Birmingham, Alabama (A)	503	590	595	982	1062	913	2352
Bismarck, North Dakota (A)	1667	1571	1553	3358	3486	3514	9192
Block Island, Rhode Island (C)	801	956	884	1608	1865	1736	5788
Boise, Idaho (A)	1226	1046	1011	2614	2365	2285	5552
Boston, Massachusetts (A)	892	1073	1026	1770	2089	2130	6045
Bozeman, Montana (C)	1468	1255	1293	3328	3207	3286	8521**
Buffalo, New York (A)	1012	1135	1104	2119	2302	2372	6822
Burlington, Vermont (A)	1126	1424	1287	2487	2848	2773	7514
Butte, Montana (C)	1591	1283	1261	3695	3451	3183	8235**
Cairo, Illinois (C)	674	755	822	1335	1430	1499	3909
Canton, New York (C)	1145	1447	1342	2539	2939	2994	8020
Charles City, Iowa (C)	1298	1330	1390	2639	2754	2895	7588
Charleston, South Carolina (C)	297	420	425	470	676	632	1769
Charlotte, North Carolina (C)	551	665	679	1033	1267	1220	3120
Chattanooga, Tennessee (A)	636	716	694	1264	1280	1225	3118
Cheyenne, Wyoming (A)	1199	1095	1144	2938	2774	2889	7466
Chicago, Illinois (C)	1004	1015	1074	1968	2089	2172	6077
Cincinnati, Ohio (C)	783	858	927	1577	1669	1796	4684
Cleveland, Ohio (A)	970	1040	1060	2050	2124	2185	6155
Columbia, Missouri (C)	880	823	985	1766	1665	1896	4922
Columbia, South Carolina (C)	437	539	561	763	978	916	2364
Columbus, Ohio (C)	885	983	1113	1820	1916	2020	5398
Concord, New Hampshire (A)	1119	1351	1234	2529	2815	2732	7353
Concordia, Kansas (C)	1030	1010	1050	2062	1983	2019	5315
Dallas, Texas (A)	447	512	567	832	933	870	2256
Davenport, Iowa (C)	1082	1066	1175	2170	2213	2333	6289
Dayton, Ohio (A)	964	1058	1014	2044	2110	1947	5264
Deer Lodge, Montana (S)	1586	1229	1331	3657	3202	3518	8672**
Denver, Colorado (C)	1011	900	1017	2213	2150	2276	5874
Des Moines, Iowa (C)	1138	1108	1215	2248	2282	2370	6384
Detroit, Michigan (A)	1032	1117	1113	2148	2280	2332	6490
Devils Lake, North Dakota (C)	1777	1726	1710	3615	3801	3871	9970
Dodge City, Kansas (A)	988	1018	1004	2036	1976	1952	5035
Dubuque, Iowa (C)	1178	1150	1243	2393	2414	2534	6790
Duluth, Minnesota (C)	1495	1530	1519	3127	3484	3489	9483
Eastport, Maine (C)	1060	1275	1228	2533	2671	2890	8520**
Elkins, West Virginia (A)	925	1024	1035	2169	2185	2217	5697
El Paso, Texas (A)	533	683	617	1149	1188	1038	2428
Ely, Nevada (A)	1429	1244	(a)	3340	3063	(a)	(a)
Erie, Pennsylvania (C)	925	1018	1039	1902	2038	2164	6273
Escanaba, Michigan (C)	1247	1277	1344	2725	2824	3138	8771
Evansville, Indiana (A)	777	873	862	1643	1734	1545	4244
Fort Smith, Arkansas (A)	653	661	707	1267	1214	1177	3147
Fort Wayne, Indiana (A)	1056	1121	1138	2222	2311	2211	5925
Fort Worth, Texas (A)	435	525	574	796	934	826	2148
Fresno, California (A)	637	612	577	1083	1112	911	2334
Galveston, Texas (C)	157	287	270	285	408	330	1016
Grand Junction, Colorado (A)	1134	1129	1162	2462	2358	2278	5548
Grand Rapids, Michigan (C)	1058	1081	1147	2181	2255	2397	6535
Green Bay, Wisconsin (C)	1271	1318	1324	2678	2777	2882	7825
Greensboro, North Carolina (A)	686	798	760	1395	1552	1395	3529
Greenville, South Carolina (A)	583	660	738	1114	1247	1334	3380
Harrisburg, Pennsylvania (A)	951	1005	992	1908	1972	1981	5375
Hartford, Connecticut (A)	1019	1154	1060	2070	2309	2157	6036
Hatteras, North Carolina (C)	404	501	493	614	774	727	2571
Havre, Montana (C)	1690	1213	1383	3329	3051	3314	8700
Helena, Montana (A)	1619	1184	1245	3459	3089	3058	7894**
Houston, Texas (C)	214	297	335	389	479	449	1157
Huron, South Dakota (A)	1425	1505	1431	2957	3171	3085	8004
Indianapolis, Indiana (A)	947	970	1017	2036	1940	2002	5298
Jackson, Mississippi (A)	405	468	(a)	748	815	(a)	(a)
Kansas City, Missouri (A)	907	859	1008	1721	1725	1866	4956
Knoxville, Tennessee (A)	701	748	781	1357	1340	1483	3670
La Crosse, Wisconsin (A)	1364	1451	1311	2759	2953	2778	7322
Lander, Wyoming (A)	1446	1260	1419	2337	3091	3075	7947

(a) Data not available.

[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

Figures in this table, with seven exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y., and Norman E. Ross, Bursar, Bates College, Lewiston Me., respectively; Anaconda, Bozeman, Butte, Deer Lodge and Livingston, Mont., through the courtesy of the Montana Power Company.

[Table concluded on page 124]

Controlled temperature and humidity of the air help reduce the breakage of fibres in this modern twisting room.

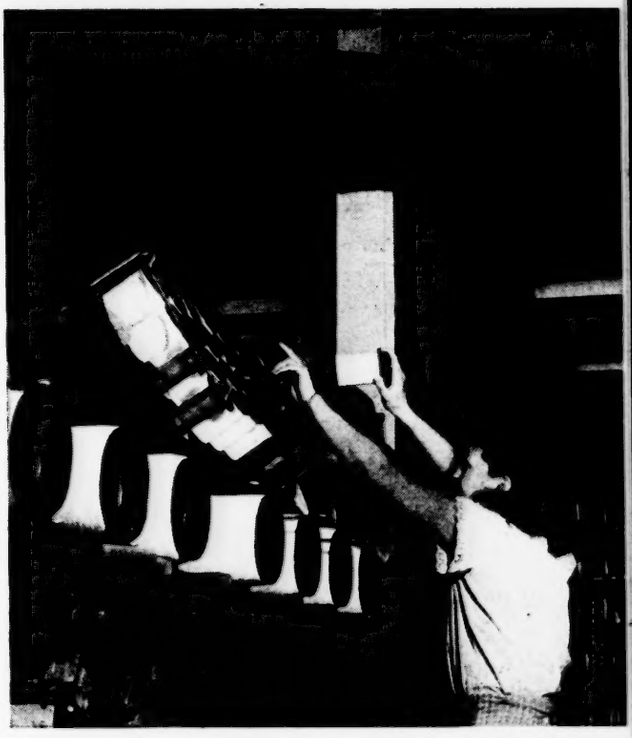
Air-Conditioning takes the snarl out of silk

In modern textile mills where silk or synthetic materials are spun into yarn, humidity control is an important factor. The web-like fibres respond sensitively to the surrounding air, becoming soggy when humidity is high and brittle when it is low. Either of these conditions can cause the yarn to foul-up or break on the fast-spinning bobbins.

In fully air-conditioned plants like that of Leon-Ferenbach, Inc., Johnson City, Tenn., losses from poor-running yarn are held to the minimum and quality is maintained at a high level. Here a Carrier central-station system delivers air of the required humidity and temperature to all departments.

The ducts in this plant and those in countless other textile mills are made from Beth-Cu-Loy Galvanized Steel Sheets. The wide popularity of these sheets in the field of industrial air-conditioning is due primarily to their excellent resistance to rust, their good workability, and their economy.

If you are a sheet-metal contractor who handles duct-work for any type of air-conditioning or heating it will pay you to keep the Beth-Cu-Loy name in mind.



Air-conditioning enables these machines to maintain tolerances of two-tenths of 1 per cent in applying sizing coats to yarn.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export Distributor: Bethlehem Steel Export Corporation

Degree-Days for December, 1948 (Concluded)

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city.

HEATING AND VENTILATING's 21st Year of Publication of Monthly Degree-Day Data

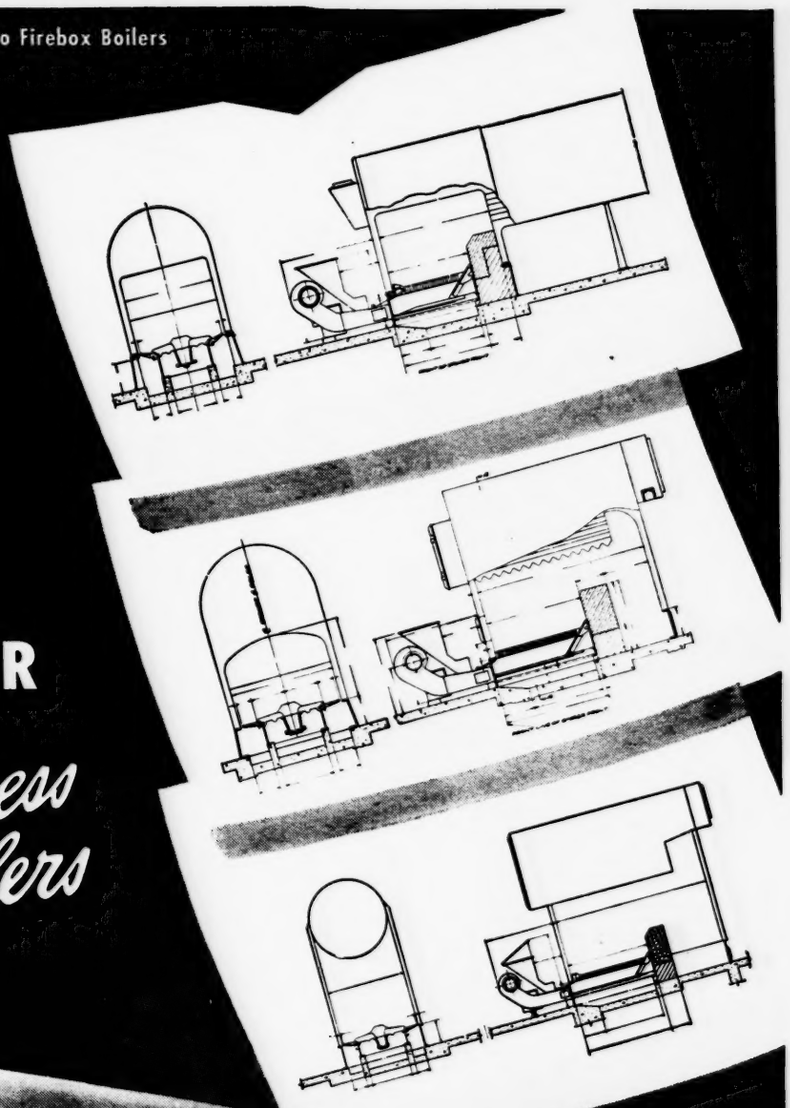
City	December			Cumulative, Sept. 1 to Dec. 31			Heating Season[1]
	1948	1947	Normal	1948	1947	Normal	Normal
Lansing, Michigan (A)	1121	1169	1209	2372	2516	2665	7048
Lewiston, Maine (O)	1082	1285	1295	2379	2690	2837	7707
Lincoln, Nebraska (C)	1152	1100	1132	2283	2196	2201	5999
Little Rock, Arkansas (A)	599	603	651	1137	1137	1079	2811
Livingston, Montana (C)	1294	1109	1117	2870	2852	2731	7245**
Los Angeles, California (C)	367	260	301	510	457	424	1504
Louisville, Kentucky (A)	775	804	849	1588	1569	1587	4180
Lynchburg, Virginia (A)	745	828	800	1539	1685	1557	3980
Macon, Georgia (C)	424	536	567	796	961	897	2201
Madison, Wisconsin (C)	1249	1270	1321	2534	2687	2758	7429
Marquette, Michigan (C)	1260	1302	1302	2777	2909	3054	8693*
Memphis, Tennessee (A)	598	637	663	1167	1165	1127	2950
Meridian, Mississippi (C)	407	484	549	789	851	883	2160
Milwaukee, Wisconsin (A)	1147	1191	1221	2384	2501	2601	7245
Minneapolis, Minnesota (A)	1396	1466	1404	2779	3031	2941	7850
Montgomery, Alabama (C)	356	429	496	640	755	769	1884
Nantucket, Massachusetts (A)	839	1000	905	1809	2070	1912	5957
Nashville, Tennessee (A)	657	733	744	1328	1338	1363	3507
New Haven, Connecticut (A)	965	1070	1017	1898	2157	2109	5895
New Orleans, Louisiana (C)	193	286	301	416	476	403	1024
New York, New York (C)	816	963	940	1505	1804	1856	5274***
Nome, Alaska (A)	1796	1424	1509	3842	3417	3379	14580**
Norfolk, Virginia (C)	551	671	685	953	1146	1195	3350
North Head, Washington (C)	772	571	654	1965	1659	1785	5452**
North Platte, Nebraska (C)	1167	1118	1173	2493	2364	2486	6366
Oakland, California (A)	617	528	496	1233	1146	1099	3143**
Oklahoma City, Oklahoma (C)	660	710	815	1270	1302	1379	3613
Omaha, Nebraska (A)	1161	1127	1175	2291	2261	2284	6131
Oswego, New York (C)	1017	1184	1138	2163	2367	2494	7088
Parkersburg, W. Virginia (C)	833	913	921	1747	1774	1830	4775
Peoria, Illinois (A)	1040	1045	1150	2141	2168	2323	6109
Philadelphia, Pennsylvania (C)	800	905	884	1465	1688	1699	4737***
Phoenix, Arizona (C)	407	432	425	663	698	581	1405
Pittsburgh, Pennsylvania (C)	859	1005	1054	1779	2035	1949	5235
Pocatello, Idaho (A)	1329	1194	1181	2947	2762	2649	6655
Portland, Maine (A)	1090	1307	1159	2452	2552	2605	7218
Portland, Oregon (C)	795	622	729	1816	1462	1724	4469
Providence, Rhode Island (C)	884	1041	1026	1761	2042	2130	6015
Pueblo, Colorado (A)	1015	981	1029	2279	2232	2164	5514
Raleigh, North Carolina (C)	568	703	694	1055	1312	1253	3234
Rapid City, South Dakota (A)	1300	1074	1172	2750	2657	2701	7118
Reading, Pennsylvania (C)	899	960	1001	1718	1864	2014	5389
Red Bluff, California (A)	711	624	(a)	1154	1143	(a)	(a)
Reno, Nevada (A)	1175	1010	973	2582	2445	2284	5892
Richmond, Virginia (C)	662	793	763	1256	1493	1380	3695
Rochester, New York (A)	1053	1186	1125	2225	2390	2414	6732
Roseburg, Oregon (C)	820	674	719	1868	1524	1741	4428
Roswell, New Mexico (A)	651	819	808	1506	1545	1510	3484
Sacramento, California (C)	678	593	574	1142	1132	996	2653
St. Joseph, Missouri (A)	1014	944	1079	1981	1924	1960	5161
St. Louis, Missouri (C)	815	811	936	1573	1646	1738	4585
Salt Lake City, Utah (A)	1232	1091	1020	2589	2369	2149	5555
San Antonio, Texas (A)	307	376	347	580	629	473	1202
San Diego, California (A)	353	289	288	561	493	487	1645
Sandusky, Ohio (C)	953	1031	1063	1979	2074	2142	6208
San Francisco, California (C)	534	436	428	1102	973	949	3264**
Sault Ste. Marie, Michigan (A)	1301	1388	1370	2943	3087	3247	9285**
Savannah, Georgia (A)	279	400	397	445	643	598	1490
Scranton, Pennsylvania (C)	1012	1105	1085	2065	2244	2274	6129
Seattle, Washington (C)	808	612	719	1980	1639	1869	4934**
Sheridan, Wyoming (A)	1376	1176	1320	2983	2887	3198	8008
Shreveport, Louisiana (A)	425	475	499	797	842	769	1938
Sioux City, Iowa (A)	1359	1297	1265	2699	2627	2583	6898
Spokane, Washington (A)	1345	1053	1057	3041	2602	2583	6355
Springfield, Illinois (C)	932	930	1039	1825	1873	2002	5373
Springfield, Missouri (A)	836	820	893	1707	1623	1674	4428
Syracuse, New York (A)	1047	1213	1172	2233	2477	2491	6893
Tacoma, Washington (C)	847	660	756	2149	1801	1951	5181**
Terre Haute, Indiana (A)	919	995	992	1945	2019	1840	4872
Toledo, Ohio (A)	1031	1142	1079	2208	2317	2189	6077
Topeka, Kansas (C)	923	913	1008	1764	1788	1883	4969
Trenton, New Jersey (C)	866	960	930	1652	1868	1760	4933
Utica, New York (O)	1051	1325	1144	2101	2588	2537	6796
Valentine, Nebraska (C)	1282	1135	1245	2749	2655	2725	7039
Walla Walla, Washington (C)	1028	812	896	2187	1839	1909	4808
Washington, D. C. (C)	758	869	896	1457	1617	1741	4626
Wichita, Kansas (A)	871	890	955	1705	1677	1783	4673
Williston, North Dakota (C)	1719	1358	1591	3418	3348	3658	9323
Winnemucca, Nevada (C)	1198	1084	1080	2694	2597	2589	6427**
Yakima, Washington (A)	1272	955	1091	2754	2242	2428	5599

(a) Data not available.
†Nome data are for November.

*Includes August.
**Includes July and August.
***New 48-year normal covering 1898 to 1946.

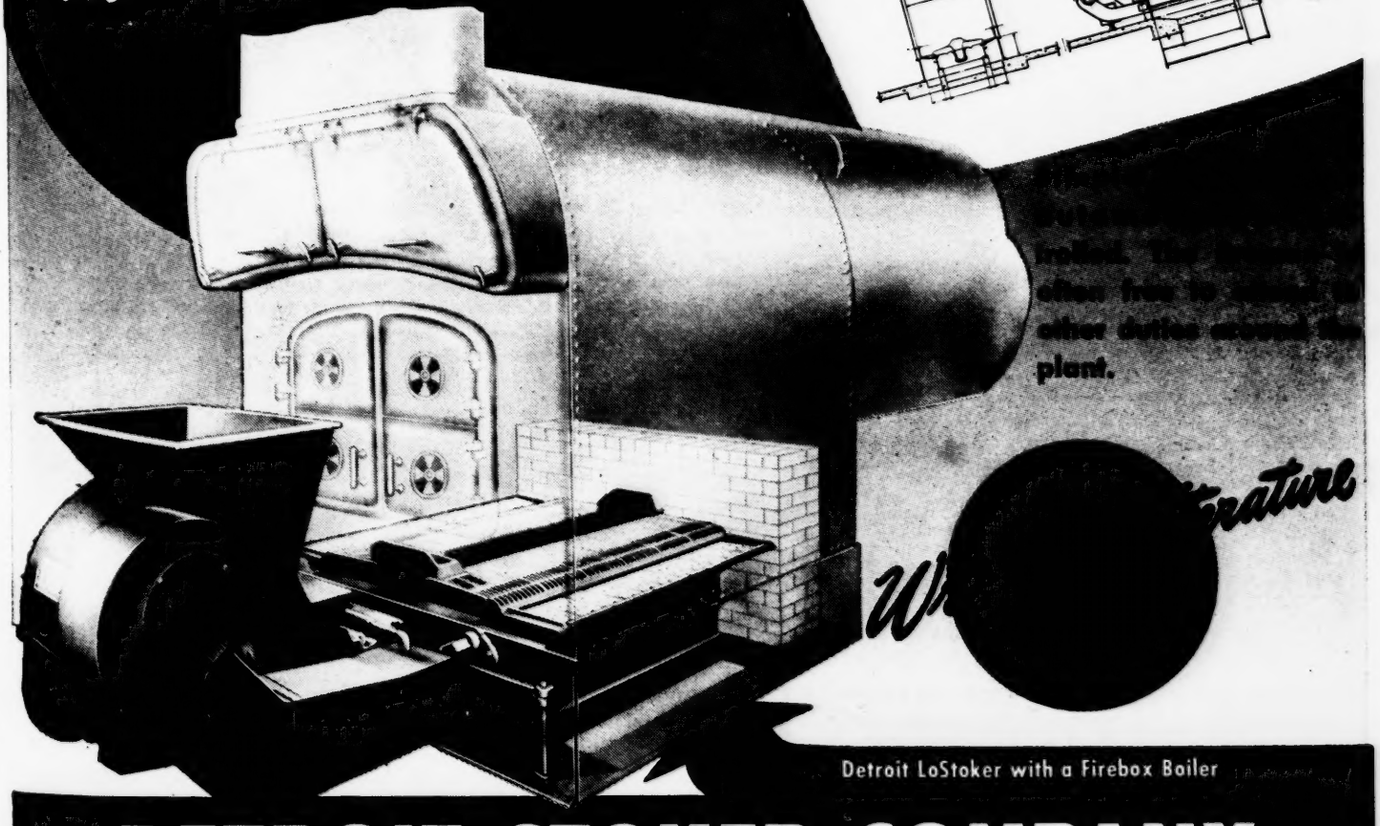
[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

Typical Applications of Detroit LoStokers to Firebox Boilers



DETROIT LOSTOKER

A Long Record of Success in Firebox Boilers



Detroit LoStoker with a Firebox Boiler

DETROIT STOKER COMPANY

GENERAL MOTORS BUILDING, DETROIT 2, MICHIGAN

WORKS AT MONROE, MICHIGAN • DISTRICT OFFICES IN PRINCIPAL CITIES

NEWS OF THE MONTH

SCREW THREAD STANDARDS

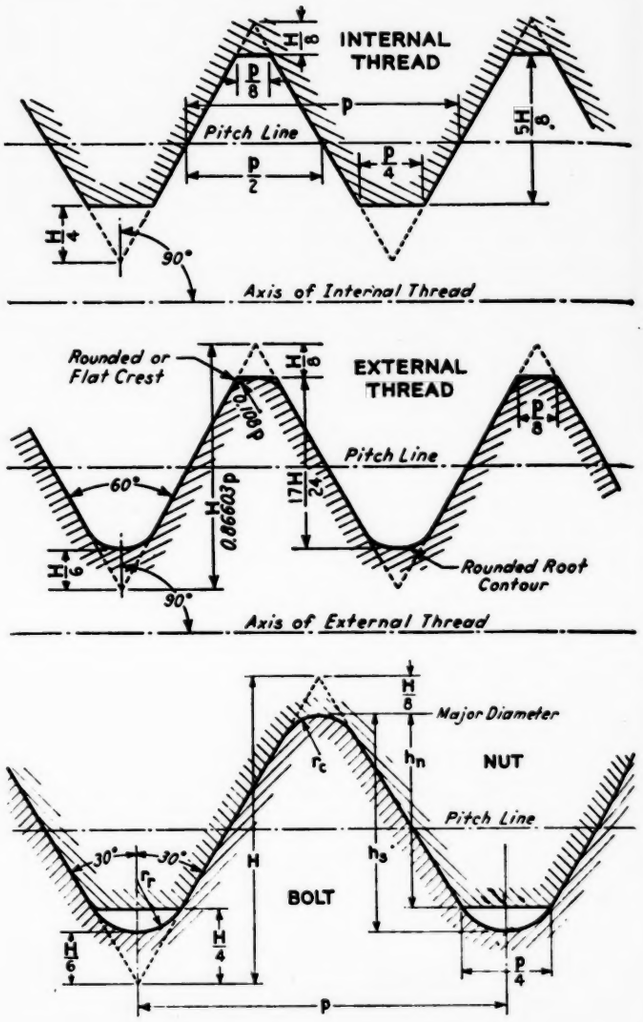
approach goal of international unity as Canada, Great Britain, and the United States sign declaration of accord.

Delegates and representatives from Government and industry of Canada, the United Kingdom, and the United States met November 18 at the National Bureau of Standards, Washington, D. C., to sign an accord on unification of the American and British standard systems of screw threads. The accord, representing the culmination of 30 years of effort among the three nations, affirms the unification represented in revised publications of the Interdepartmental Screw Thread Committee of the United States of America and of the British Standards Institution, the Canadian Standards Association, and the American Standards Association. These documents fulfill all the requirements for general interchangeability of threaded products made in the three nations.

The Unified Standards will be made effective in the Departments of the U. S. Government by inclusion in the next revision of Handbook H 28, *Screw Thread Standards for Federal Services*, of the National Bureau of Standards.

The significance of the accord is patent in the field of commerce. In the past, international trade in mechanisms of all kinds has been seriously handicapped by the lack of interchangeability of screw thread parts. This has required the manufacturing nation also to supply and distribute such parts along with the equipment it wishes to market in a foreign area. Furthermore, the question of the availability of such parts has acted as a psychological deterrent to purchasers of products from other nations. These limitations on the international commerce of Canada, the United Kingdom, and the United States will gradually disappear as the unified standards are acted upon by the industries of the three nations in the ensuing years.

C. D. Howe, Canadian Minister of Trade and Commerce, signs the American-British-Canadian accord affirming the unification of the screw thread standards used by the three nations. Left to right: Mr. Howe; Dr. E. U. Condon, Chairman of the Interdepartmental Screw Thread Committee of the United States and Director of the National Bureau of Standards; and Hume Wrong, Ambassador of Canada.



American preferred form of internal thread (above) with flat crests and roots; the unified external thread form (center) with rounded roots and either rounded or flat crests; and the British preferred form (lower) with rounded root contours and flat crested internal thread (H = 0.866025p; r_c = 0.108253p; r_r = 0.144338p)

• **TECHNICAL BASIS.**—The three principal characteristics of screw threads are angle and form of thread, pitch (the combinations of diameter and number of threads per inch for the various thread series), and limiting dimensions (the manufacturing tolerances and allowances) for each grade of thread fit.

The British system, originated by Whitworth in 1845, is based on a thread angle of 55 degrees with a thread form having rounded crests and roots. The American system, developed by Sellers in 1864, has a thread angle of 60 degrees with a thread form having flat crests and roots. The number of threads per inch for the various series of thread diameters was the same in both systems, with the exception of the half-

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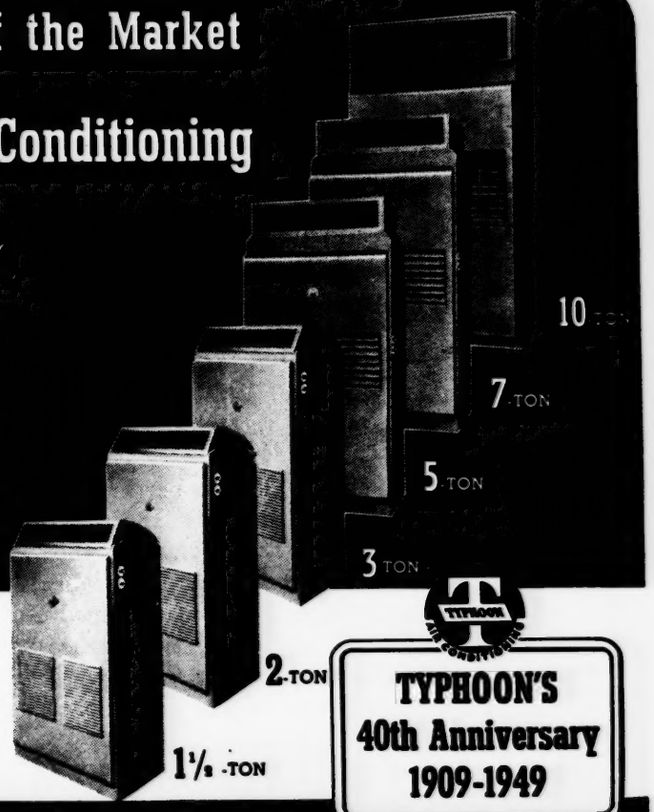

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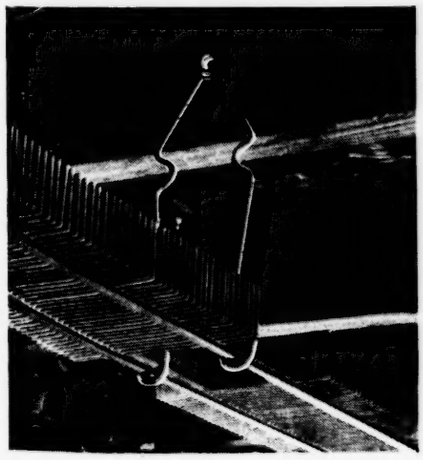
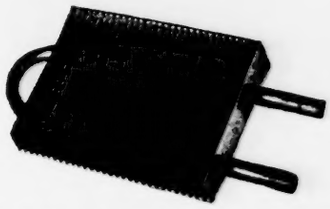


Coils ready to raise on hangers.

KRITZER RADIANT COILS are easily laid across the joists and can be installed in the ceiling without difficulty. Ideal for use in any type of hot water heated building. Available from your jobber in all standard lengths. Or write to KRITZER RADIANT COILS for literature and engineering bulletin.

- LOW INSTALLATION COST
- LIGHT IN WEIGHT
- PERMANENT
- LEAKPROOF
- EASY TO INSTALL

Soldering connections.



Kritzer Finned Return Bend is a standard section placed at the end of finned tube run.

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inch coarse thread. Accurate fits between components having different thread angles were impossible, and tolerances and allowances varied in the two systems.

The present unification agreement provides a 60-degree angle and a rounded root for screw threads. The crest of the external thread may be flat, as preferred in American practice, or rounded, as preferred by the British. The number of threads per inch for the various series of thread diameters has been unified, and the limiting dimensions for three grades of fit have been agreed upon. Thus, interchangeability of screw thread parts, based on the accord, now becomes feasible.

The sizes agreed upon, the threads per inch, and the basic dimensions of the unified coarse and fine thread series have been tabulated. These tables, together with agreements on tolerances, assure interchangeability of threaded products. Threaded parts of standard diameters and threads per inch, made in accordance with these principles, will always assemble freely.

There is, however, a further degree of interchangeability attained by agreements on the numerical values for allowances and tolerances, thereby setting limits to the least and greatest amounts of looseness between mating parts. Such agreement provides for identity of sizes (or interchangeability of use) of screw thread gages used in the different countries for controlling the limits of size of the threads. It also standardizes the grade or grades of fits between mating parts.

A few details remain to be agreed upon. An editing subcommittee, consisting of representatives of the three nations, was appointed by the Sectional Committee B1 on the Standardization and Unification of Screw Threads at its meeting on November 18, 1948. This subcommittee was authorized to resolve, within specified limitations, the differences which remain. Any agreements reached will be incorporated in the American standard without further formal action by the three governments.

• **DEVELOPMENT.**—The Unified Screw Thread Standard was formulated in five major and several informal conferences of representatives of the countries concerned. In July 1918, the Congress of the United States authorized the appointment of the National Screw Thread Commission, with the Director of the National Bureau of Standards as chairman, to investigate and promulgate standards for screw threads. One year later, and after a thorough study of screw thread practice in this country, the Commission conferred with British and French engineers and manufacturers of screw thread products, for the purpose of discussing the tentative report which it had prepared with the hope that it might serve as a basis for international standardization. No definite agreements were reached, but the need for continued study was recognized.

In 1926, a further attempt was made to unify thread standards, when a British mission visited the United States and proposed a basic thread angle of 57½ degrees. The compromise was not considered acceptable.

In 1943, a British mission visited the United States, at the invitation of the Combined Production and Resources Board, and Canadian representatives were also invited to participate in the discussions, in which notable progress was made on projects of immediate concern. In August-September 1944 a joint United States-Canadian group, sent to London by the same board, conferred with committees of the British Standards Institution.

In September-October 1945, under the auspices of the same board, a conference on Unification of Engineering Standards was held in Ottawa, Canada. At this conference a unified form of thread having a 60-degree angle, together with standard sizes and pitches, was agreed upon. The foundation was thus laid for the standards to be agreed on, but a vast amount of work remained to be done in developing and agreeing upon grades of fit and corresponding classes of tolerances and allowances. When a British delegation visited the United States in July 1948, basic mathematical formulas for such tolerances and allowances were tentatively agreed upon and later ratified by correspondence, thus making possible the completion of the standards at the meeting.

• **FUTURE.**—In one sense, the present accord marks the culmination of thirty years of work by the three nations toward the establishment of unification. In another sense, the accord marks the beginning of the realization of the unification. Purchases by the three governments will be based on the new standards, but industrial use within the normal commerce of each of the nations will require a transformation of industrial practices, involving considerations of engineering, design, tooling, and production. Such a change will take time but should be completed in the next few years.

At the same time, continued screw thread research is important. A screw thread is one of the more complex regular geometrical forms. There are so many variables which enter into the design of a satisfactory threaded fastener that most of the knowledge applied in such design has been empirical rather than theoretical. An immediate result of the Ottawa Conference in 1945 was the establishment of the program of research to be carried out by the National Bureau of Standards of the United States, the National Physical Laboratory of England, and the National Research Council of Canada.

The present accord calls for a continuance of future cooperation in the field of screw thread standardization. Such cooperation has two aspects: first, the extension of the unification to the other English-speaking nations (all of which use the English system of measurement in manufacture) and, second, the continued development of standards. For standards are not static, and they must keep pace with improvements in materials and methods of production and inspection developed in industry. The reduction of the varieties of fasteners is one of the possibilities which further studies of standards and simplification may yield.

Moreover, the present accord pertains to the most commonly used type of screw thread. Other important types of screw threads remain to be standardized.

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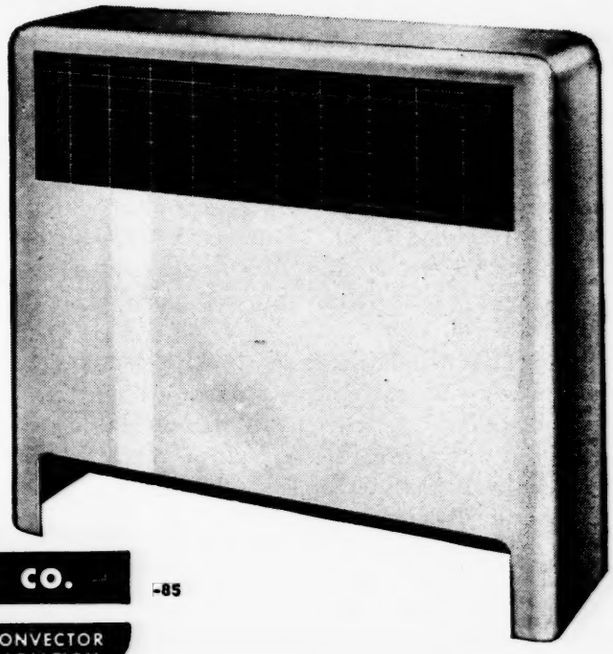

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The above appeared in The New York Times, Dec. 12, 1948—concerning the largest and most talked-about FHA insured garden apartment colony in the U.S.A. The underground steam conduit, of course, is

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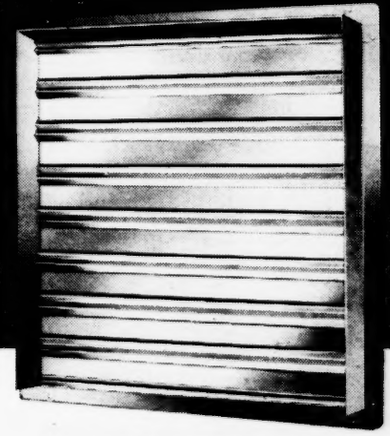

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Aluminum louvers open fully, permitting capacity fan operation. New heavy reinforcement strip adds strength and long life to the louvers, assures quiet operation and perfect counterbalance, prevents rattling. Deep shroud protects shutter from high winds. Tie-rod, brackets and bearings inside frame, not exposed to weather. Special finish resists corrosion. Many other features.

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ELECTRONIC SMOKE CONTROL

for stairwells overcomes chimney effect and confines smoke damage.

A new electronically-controlled exhaust system for preventing the chimney-like spread of smoke and fire gases through a burning or smoke-filled building was demonstrated at Hartford, Conn., recently. The system was installed at the Sage-Allen department store.

In the demonstration, billowing clouds of smoke from chemical bombs filled the basement selling floor of the store. In less than ten seconds, the system detected the smoke and began drawing it into collection ducts which carried it out of the building. Without the system the smoke might have spread to other floors through the moving stairway opening in the center of the store.

• **FIRST.**—The installation is the first to combine electronic smoke detection with an exhaust system for fire protection purposes, reported William Haine, vice president of the store. He explained that the technique uses a Walter Kidde Co. smoke detector and Westinghouse exhaust apparatus, and was developed from an exhaust water spray system that was devised jointly in 1947 by engineers of the Westinghouse Electric Corp., Otis Elevator Co. and Grinnell Co., Inc.

The Sage-Allen system for combating smoke was installed to supplement the store's existing sprinkler system for fighting fires because, Mr. Haine contended, "smoke spreads faster than fire and consequently constitutes the bigger threat to a completely sprinklered building.

"It is commonly recognized that the superheated air and toxic gases which accompany fire are its principal killing agents," the store official pointed out.

• **FAN EXHAUST.**—Store officials became interested in a smoke control system last year, Mr. Haine said, when they asked Westinghouse to install six electric stairways in the center of the store. They knew that fumes and smoke spread through a building up unprotected openings, shafts and wellways, and that by installing the six stairways they were creating just such a possibility, he added.

Smoke test shows how smoke rising through stairwell (left) is captured (right) when exhaust is turned on.

To provide a controlled path for smoke removal, the system utilizes collection ducts surrounding the stairwell on each floor. These ducts lead to an exhaust fan on the roof which can draw out 32,000 cfm.

Nearby on the roof is a louvered penthouse directly over the stairwell. It is through the louvers that fresh air is drawn down into the building.

• **ELECTRIC EYE.**—Each floor has an independent detection unit. Through six tiny inlets on each floor, called accumulators, continuous samples of air are drawn by a small fan to the basement. There a composite sample for each floor is formed continuously 24 hours a day and passed under the surveillance of an electric eye.

When there is even a slight amount of smoke present, the electric eye in a split-second, even while it is stopping the electric stairways and ringing an alarm in the boiler room, activates the exhaust system. It starts the exhaust fan, opens the collection duct damper on the floor where smoke is detected, closes all other floor dampers and opens the fresh air intake. All this takes place simultaneously, Mr. Haine said.

The result? Smoke is pulled into the collection ducts on the floor where it originates and is removed from the building. The gentle fourteen-mile-an-hour smoke movement produced by the fan creates a partial vacuum in the stairwell. As a result cool fresh replacement air rushes down from the roof and helps to push smoke into the collection ducts. This downdraft constitutes an invisible air wall that prevents smoke from passing floor to floor.

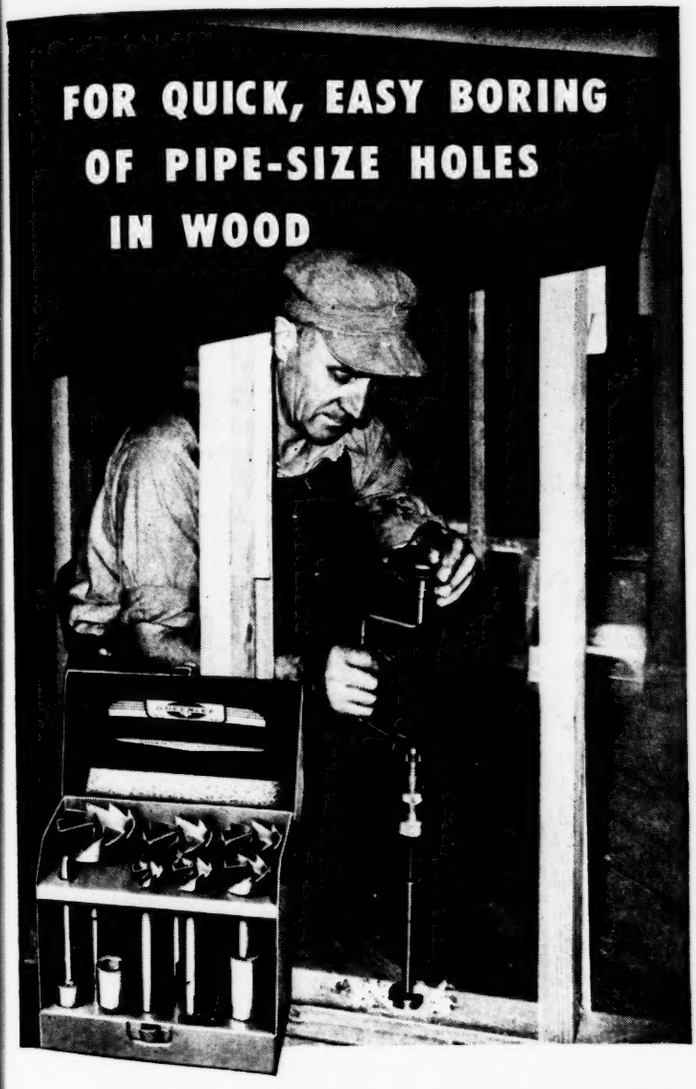
Stopping the electric stairway converts them into conventional stairways so that both "up" and "down" units can be used for escape purposes, if necessary.

• **AIR SAMPLES.**—Operation of the electronic detector was explained by S. G. Frack, manager of the industrial department of Walter Kidde of Belleville, N. J. The six air samples from each floor are drawn into an individual eight-foot-long tube in the basement. A lamp behind a lens at one end of the tube projects a light beam down the tube to a sensitive electric eye.

Smoke in the sampling air decreases the light reaching the photocell, causing its electric output to drop. When it falls below a safety point, sensitive relays activate, or "alarm," the exhaust system. Mr. Frack said the detection equipment was similar to that used on ships of all types and in many land installations.

Walker G. White, manager of contracting operations of the Westinghouse Elevator Division, of Jersey City, N. J., described how the six moving stairways, capable of carrying 36,000 persons an hour, solved a transportation problem for the store, but at the same time created the need for protecting the stairway opening against the passage of smoke. He also told how the Westinghouse-Otis-Grinnell group developed the original exhaust water spray system.

Ethan Allen Dennison of New York was the architect for the installation; Dwight D. Kimball, also of New York, was the consulting engineer. The Southern New England Construction Co. of Hartford, Conn., was the general contractor.



. . . the new GREENLEE PIPE BIT SET

Designed especially for plumbers, steamfitters and electricians to provide fast, easy boring of accurate holes in wood for ½" to 2" pipe and conduit. Makes swift, easy work of an otherwise tedious, hard job! The set is furnished in a sturdy, attractive metal box with convenient carrying handle. Bits have ½" shanks for use in portable electric or pneumatic drills and in stationary boring machines. An adapter is provided for standard auger-bit braces. Adapters are also furnished for using standard ⅜" pipe as an extension for deeper boring and longer reach. Get facts today on these timesaving GREENLEE tools. Write Greenlee Tool Co., Division of Greenlee Bros. & Co., 2322 Twelfth Street, Rockford, Illinois.

TOOLS FOR CRAFTSMEN

GREENLEE

Time was saved "at every turn" because "K" Fittings made up fast. This upped the profit considerably above the estimate.

Because "K" Fittings are chamfered and tapped on precision machines, pipes enter and screw in easily. In the case of "K" flanged fittings, the faces are accurately milled and drilled. Fittings are carefully inspected and gaged.

Ask your supplier for "K" Fittings.

The "K" line of 3000 shapes and sizes of cast-iron fittings includes:

- **Standard and Extra Heavy Screwed Fittings**
- **Standard and Extra Heavy Companion Flanges**
- **Standard Flanged Fittings**
- **Drainage and Sprinkler Fittings**

K PRECISION FITTINGS

KUHNS BROTHERS CO.
DAYTON 1, OHIO

COMBINED MARKET FACILITIES with Malleable Iron Fittings Company, Branford, Conn., and Kuhns Bros. Co., Dayton, Ohio

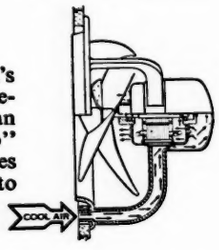
BIGGEST NEWS SINCE THE INVENTION OF THE SELF-COOLED MOTOR!

NEW TYPE "Q"
SELF-COOLED MOTOR
PROPELLER FAN

ILG VENTILATION

It's NEW from motor cover to frame, yet it's proved in thousands of installations! Certified ratings testify to remarkable capacity. Decibel ratings vouch for amazingly quiet operation. All ILG's famous features for high efficiency, power-saving economy, minimum maintenance and long life are built in. Now available in all sizes up to and including 30" fan wheels. Hurry—get the complete story in ILG Catalog No. 148—send coupon or phone nearby Branch Office (consult classified directory).

Specify the Self-Cooled Motor—it's exclusive, patented, ILG-built. Designed specifically for exhaust fan duty. Motor never "gums-up" from contact with foul air, requires minimum maintenance, adds to long life of entire unit.



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Offices in more than 40 Principal Cities

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FUEL CURBS

ended as Truman revokes conservation order covering oil and gas.

Acting on assurance that fuel shortages are no longer a threat to supplies of oil and gas, President Truman revoked in mid-January an emergency conservation order issued one year ago covering those fuels. He also took the occasion to compliment the entire federal establishment for efforts during the past year resulting in reduction of fuel consumption and overcoming shortages.

The President noted that spot shortages still exist in some areas but said that crisis conditions no longer threaten.

• **INDUSTRY PROGRAM.**—The petroleum industry, in an action not formally related in this order, made known its own program through publication by the National Petroleum Council of a detailed study made at the request of J. A. Krug, Secretary of the Interior.

Walter S. Hallahan, chairman of the council, remarked that since the war the American oil industry has found it necessary to engage in the greatest expansion program in history. Mr. Hallahan pointed out that this program was an example of peacetime cooperation between government and private industry.

"Continuing our supply to meet our national oil needs," the report stated, "depends primarily on availability from domestic sources. Due consideration should be given to the development of foreign oil resources, but the paramount objective should be to maintain conditions best suited to a healthy domestic industry."

• **PRICE CUTS.**—The Atlantic Refining Co. began a third round of price reductions in heavy fuel oil in mid-January with cuts ranging from 10 to 22 cents a barrel. Previous cuts had been one of 25 cents a barrel announced December 27 and another 25 cents a barrel announced earlier in January.

FAN SELECTION

simplified by uniform testing method developed by cooperating associations.

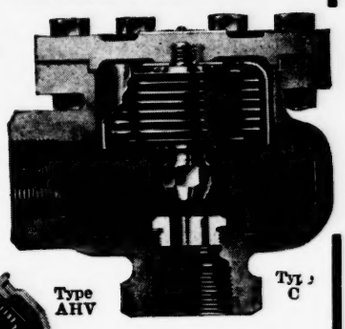
Selection of fans may be simplified by a plan announced by the National Association of Fan Manufacturers proposing a standard method of testing based on capacity and performance.

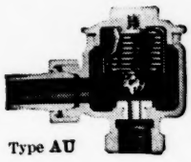
NAFM in collaboration with ASHVE and ASME has developed a standard test code for centrifugal and axial flow fans. Fans tested and rated in accordance with the code may be identified by a seal or label adopted by NAFM and bearing the title "Certified Ratings" and a legend to the effect that the labeled product has been tested under provisions of the joint code. The Association will license use of the seal or label to a manufacturer who agrees to publish fan ratings which are the results of tests made in accordance with the standard code and who also agrees to maintain manufacturing control of fans within specified tolerances. No charge is made for the license agreement.

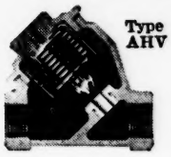
Nicholson Steam Traps Show

PRODUCTION INCREASES UP TO 30%

2 to 6 Times More Drainage Capacity Speeds Circulation







Bulletin 1047 or see Sweet's

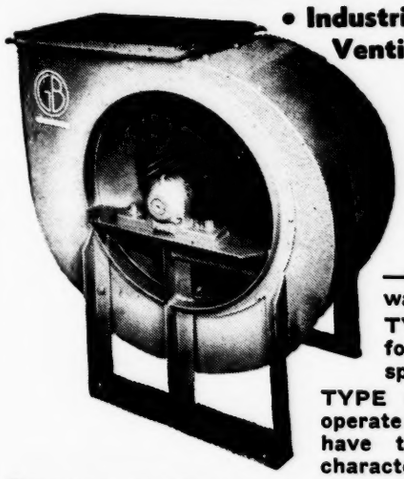
Plant records show that the unequalled drainage capacity of Nicholson thermostatic steam traps increases production up to 30%. Other reasons why an increasing number of leading plants are standardizing on Nicholson: operate on lowest temperature differential, 5° to 15°, depending on trap size and steam pressure; record low for steam waste (as low as 1%). 5 types for every purpose: size ¼" to 2"; pressure to 225 lbs.

W. H. NICHOLSON & CO. 199 OREGON STREET WILKES-BARRE, PA.

Valves ★ Traps ★ Steam Specialties

★ **VENTILATING FANS**

GB Fans—*manufactured for*



- **Industrial and Commercial Ventilating and Heating**
- **Fume Extraction**
- **Induced Draft**
- **Forced Draft**
- **Air-conditioning**
- **Drying and Processing**

—are of forward or backward curved wheel design.

TYPE F. C. are designed for quiet operation at low speeds.

TYPE B. C. are designed to operate at high speeds and have the non-overloading characteristics.

Capacities of 200 c.f.m. to 300,000 c.f.m. are covered by standard sizes and arrangements.

The heavier constructions of classes II, III and IV cover the particular needs of special applications.

Send for Bulletin SC-103

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Moisture Destroys Insulation Values

"Moisture increases the rate of heat transfer through a material, because water, which fills the pores or voids, conducts heat more rapidly than air." . . . *Third edition of "Insulation," by Paul D. Close as Technical Secretary of Insulation Board Institute and former Technical Secretary of the American Society of Heating and Ventilating Engineers.*

Infra Insulation is impermeable to water vapor

That is one reason why Infra—the multiple sheet aluminum insulation—is the best way to insulate even a basementless house. Moreover, it is non-condensation-forming and easy to install in crawl spaces. Infra prevents heat from entering or escaping a building through ceiling, wall or floor. Observe, for instance, the remarkable results for DOWNWARD heat flow in the table of thermal factors below. These values are permanent. Infra will remain in place and not tear at the staples or elsewhere because of moistened paper and excessive weight.

Thermal Factors Stamped on Every Infra Carton

Infra C Factors and Rockwool Equivalents

C.052 Heat Flow Down, equals 6" Rockwool.
C.083 Heat Flow Up, equals 4" Rockwool.
C.10 Lateral Heat, equals 3-1/3" Rockwool.

The scientific construction of Infra, with two separated aluminum sheets, provides 4 reflective spaces and 4 reflective surfaces, each non-condensation-forming and 97% effective against heat rays. The two sheets of aluminum and the accordion partition block convection. The two rows of inner, alternating triangular air spaces, and the small mass eliminate conduction as a problem.

WRITE FOR FREE 32-Page Booklet: "Simplified Physics of Thermal Insulation"

Architects and engineers use it as a handbook, and colleges as a text, on heat transfer, condensation, vapor, mold, radiant heating, etc. Contains master chart of *k*, C, R and U factors of all insulations, of all thicknesses, weights, densities, etc. Address Dept. HV.

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Infra INSULATION, INC.

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for • SPRAYING
• WASHING
• RINSING
• COOLING
• AIR CONDITIONING

YARWAY

SPRAY NOZZLES

FAN-TYPE FOR FLAT SLICING SPRAY

Get the most out of your Spraying Equipment with minimum power . . . with efficient spraying.

Use Yarway Nozzles. No internal vanes or other restrictions to clog or hinder flow. Two types—Yarway Involute-type producing a fine hollow spray with minimum energy loss, and Yarway Fan-type producing a flat fan-shaped spray with time-saving slicing action for cleaning.

Wide range of standard sizes and capacities. Cast or machined from solid bar stock.

Thousands in use. - - Write for Bulletin N-616.

YARNALL-WARING COMPANY
104 Mermaid Avenue Philadelphia 18, Pa.

GAS SERVICE

aided by government-industry research on methods to prevent formation of hydrates in gas lines.

A joint investigation, started in 1935 and recessed during the war, has been conducted by the Bureau of Mines in cooperation with the Natural Gas Department of the American Gas Association. Objective was to devise means of preventing the "freezing" of natural gas transmission lines which results from the formation of crystalline compounds known as hydrates.

• **CHEMICAL.**—Hydrates are formed by the chemical combination of water and natural gas. They solidify at temperatures considerably above the freezing point of water and form ice-like plugs which obstruct and completely stop the flow of gas. These formations occur more frequently in high pressure gas lines.

Removal of water from natural gas prevents the formation of hydrates. The Bureau report describes various types of dehydration plans for drying gases and also discusses the kinds of freezes that occur, their frequency, location in the lines, temperatures at which they occur, and remedial measures.

• **INSTRUMENT.**—Bureau engineers developed an apparatus to determine the dew-point of gases under pressure, now widely used throughout the natural gas industry. This apparatus was constructed by the authors of the report, W. M. Deaton, helium engineer, and E. M. Frost, Jr., chemical engineer, both of the Amarillo, Texas, helium plant. A description and illustration of the equipment are given in the publication along with various charts and bibliographies on hydrates of gases, dehydration of gases, and water-vapor content of gases.

Requests for copies of the report, "Gas Hydrates and Their Relation to the Operation of Natural-Gas Pipe Lines," *must* be addressed to the American Gas Association, 420 Lexington Avenue, New York 17, N. Y. This report is *not* sold or distributed by the Bureau of Mines.

GLYCOL VAPOR

to be tested as health measure in Chicago Tribune offices.

Sterilization of air in offices with glycol vapor will be tested this winter in the Chicago Tribune's telephone ad-taking area, Dr. Theodore Van Dellen, head of the Tribune medical department, disclosed this week.

• **RECORDS.** — Health records maintained by the Tribune will enable the medical department to compare the time lost through sickness during the test period with records for the same period last year. Sterilizing of air throughout the entire new eight-story annex to Tribune tower may be attempted if an appreciable improvement results.

• **EQUIPMENT.**—Liquid glycol, vaporized as it spirals around a heated pipe and distributed throughout the room by a fan, is expected to kill many harmful bacteria. Some medical authorities suggest that glycol clinging to the membranes of workers' lungs may pro-

Solenoid Valves

STAINLESS STEEL

ACTUAL SIZE

★ Standard pressure range, 5 to 250 psi
★ Dimensions 2¾" high x 1⅝" dia.
★ Impregnated coils withstand moisture and condensation
★ Soft insert seats prevent leakage
★ Spring loaded for positive action
★ Stainless steel parts highly resistant to corrosion and wear
★ Power consumption 10 watts max.
★ Pipe connections to specification
★ Also many special valves for handling pressures from 5 to 850 psi

THREE WAY - TWO POSITION
TWO WAY - NORMALLY CLOSED
TWO WAY - NORMALLY OPEN

Skinner will be pleased to make recommendations on your particular design applications — they have for hundreds of others. Write today for details and catalog.

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Skinner ELECTRIC VALVE DIV.
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SEE— for yourself

How a fast-running repair job is done in an old hotel

You can do more work every day when you bend pipe with a

TAL Portable Bender

Work goes faster when you bend on the job — either original installation, radiant heat or repair. Fewer joints to leak in the future, less friction, more satisfaction for your customers and a bigger profit for you. Do as hundreds everywhere are already doing. Write for illustrated data bulletin. Dept. 12.

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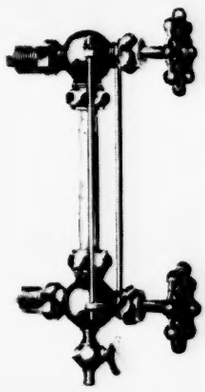
FOR BETTER WATER GAUGES

USE Roberts

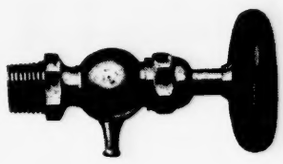
- **SOLID BRASS**
- **SELF-CLEANING**
- **FOR WORKING PRESSURES Up To 175 POUNDS**



For decades Roberts Water Gauges have been a standard of quality wherever tubular glass gauges are used.

Modern design—made of solid brass with plenty of strength. Self-cleaning feature keeps lower part of gauge from clogging with scale. Special packing allows free expansion of glass, avoiding breakage.

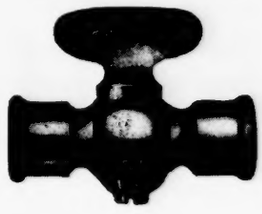
COMPRESSION GAUGE COCKS



Solid brass, durable, with seats that stand long use. Model shown has stuffing box.

Also offered in light pattern less stuffing box.

AIR COCKS—STEAM GAUGE COCKS



Roberts makes air cocks of all types and steam gauge cocks for pressure gauges.

All sizes – 1/8" up to 1/2".

Write for information on Roberts Gauges and Cocks.

THE ROBERTS BRASS MANUFACTURING CO.

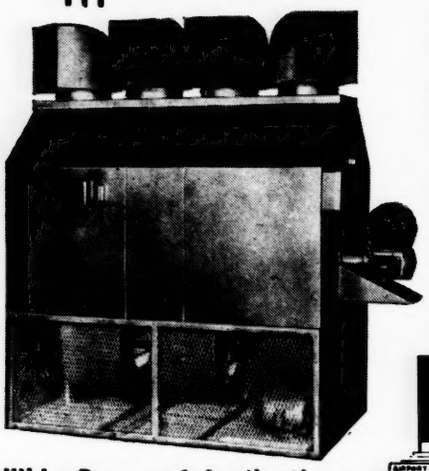
Manufacturers of Brass Goods for Steam, Water, Gas and Air

5435 WEST FORT ST. • DETROIT 9, MICH.

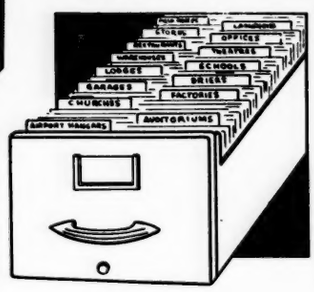
NATIONAL CHAMPION

GAS and OIL BURNING DIRECT FIRED UNIT

HEAVY DUTY FORCED AIR UNITS FOR LARGE SPACE HEATING REQUIREMENTS



A self-contained unit with adjustable discharge heads for positive heat delivery in any direction. Streamlined fire box of high heat and corrosion resisting Type 310 Stainless Steel insures a far longer life of service and satisfaction. Tear Drop combustion chamber design and convector tube arrangement affords complete efficient air wipage of all heating surface at minimum resistance. Available in models for central heating systems employing supply and return ducts.



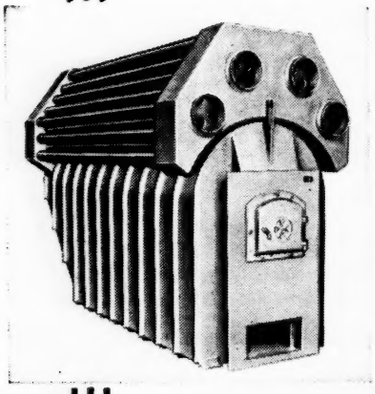
Wide Range of Applications

These units have proven practical and economical for most types of public, commercial and industrial buildings. National Champion heaters are the product of over a half century of experience in this field and the latest advanced engineering features of these units have been tested in a rapidly increasing range of actual installations.

GENERAL CAPACITY DATA

Model Number	Btu	Cfm	hp	Dimensions (inches) length-width-height			Approximate Shipping Wt., Lbs.
T.D.— 25	250,000	3,600	¾	60	32	81	1,300
T.D.— 40	400,000	5,400	1	60	32	81	1,350
T.D.— 50	500,000	6,600	1½	80	32	81	1,780
T.D.— 70	750,000	8,800	2	80	32	81	1,855
T.D.— 80	800,000	10,200	3	80	48	81	2,110
T.D.—100	1,000,000	12,500	5	80	48	81	2,200
T.D.—125	1,250,000	15,300	5	100	54	103	3,000
T.D.—150	1,500,000	19,400	7½	100	54	103	3,250

NATIONAL HEATER COAL FIRED FORCED AIR UNIT



Specifically constructed and designed for stoker and hand firing with blower position at rear or side of casing, this unit embodies all the features of other NATIONAL heaters for greater satisfaction and economy of operation. Can be quickly and efficiently converted to light oil, heavy oil or gas firing as future fuel costs and supplies may necessitate.

• *Write for Literature*

NATIONAL HEATER CO.
CLEORA & VANDALIA STREETS
ST. PAUL, MINNESOTA

tect them for a short while even after they have left the office.

Equipment to be used in the Tribune test is a little bigger than a standard typewriter case and is operated by electricity from an ordinary wall socket. Dr. Van Dellen hopes to attach such a device to the air conditioning system in order to sterilize all the air in the Tribune tower annex as it is circulated if the test indicates that the glycol vapor is effective.

VENTILATING TOWER

for Brooklyn-Battery Tunnel will rise from middle of New York Harbor.

A huge ventilating tower to supply air to the Brooklyn-Battery Tunnel will rise out of the water in the middle of New York Harbor. Planned for completion in 18 months, the tower will rise 126 ft above the water and will be 125 ft in diameter. Exterior will be of light colored brick with light granite trim.

Within the structure twelve intake fans and twelve exhaust fans will change 18,000 tons of air an hour in the two-mile tubes. Additional ventilating buildings on the Brooklyn and Manhattan ends of the tunnel, bringing the total number of fans used to fifty-three, will increase the capacity of the ventilating system to 24,000 tons of air an hour. Air in the tunnel will be completely changed every 90 seconds, according to Ralph Smillie, chief engineer for the Triborough Bridge and Tunnel Authority.

• **REMOTE CONTROL.**—Except for an occasional inspector, cleaner, or repairman, no one will occupy the tower in the bay. Fans will be run from a central control board in the Brooklyn building where operators will have the entire ventilating system under their control and will observe the continuous record of air samples from representative locations. The bottom of the ventilating shaft is 140 feet below the surface of the water.

METHYL BROMIDE POISONING

can be insidious and fatal hazard in unventilated space, as pointed out by New York State Department of Labor official.

Methyl bromide has been produced and used in the chemical industries for many decades as an intermediate in the production of other chemicals. A review of recorded cases of methyl bromide poisoning is presented in the New York State Department of Labor monthly review by Dr. Ludwig Teleky of the Division of Industrial Hygiene and Safety Standards. The first reported case dates back to 1899.

• **LATENT PERIOD.**—Dr. Teleky reports two cases which he saw himself, a characteristic accident showing how insidious methyl bromide poisoning may be. Because of the latent period known to elapse between exposure to this gas and the onset of symptoms, Dr. Teleky advised the manager of a plant (after the appearance of the first case) to send any suspected

case to the hospital regardless of symptoms. In accordance with this, he sent a man to the hospital suffering from slight dizziness and fainting which, however, were transient and had disappeared. Six days later the man was sent home by the chief of the clinic asking why a healthy man with only a slight innate nystagmus was sent to the hospital in the first place. That was November 9. Between the 9th and the 15th, the patient did not work in the factory, but on the 15th, while working in an open field, he suffered another attack of dizziness and fainting, which was followed by manic symptoms. These symptoms were repeated once or twice daily. Although the attacks gradually grew less severe, attacks of unconsciousness appeared over four months later, at which time there were still to be found tremor and psychic changes.

• **FIRE EXTINGUISHERS.**—From various reports covered between 1928 and 1945 it became apparent that not only were persons endangered who were producing, filling or repairing methyl bromide fire extinguishers, but users of these fire extinguishers and those who kept them in their homes were also in danger. In France, a family had a methyl bromide fire extinguisher hanging on the wall. It dropped and a hairline crack developed which, however, was not observed. The extinguisher was replaced on the wall. A 19-month-old child died and the parents had a number of epileptiform seizures.

The British Navy reported 26 cases of methyl bromide poisoning, seven of which were fatal. In one case, methyl bromide from a fire extinguisher apparently penetrated into a machine room and a messroom. One man died 16 hours after he had finished his watch in the machine room. Two messmates who had helped this man out to the deck went back to the messroom and after staying five minutes went back on deck because they were not feeling well. There they collapsed and died.

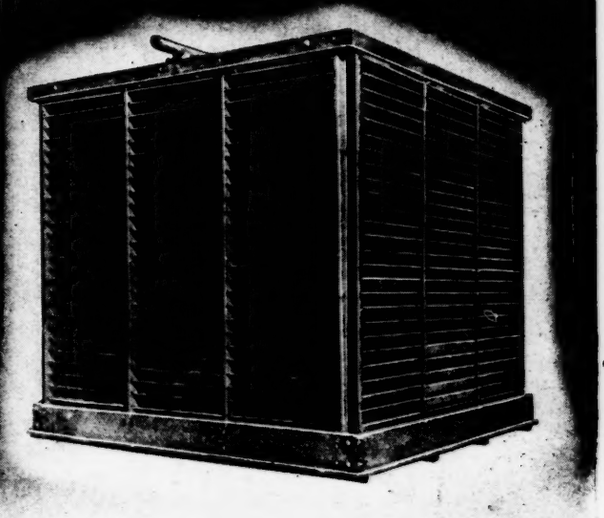
• **INSECTICIDE.**—Poisoning increased during the war when methyl bromide began to be packed in small ampules for delousing soldiers' clothing. Exposures involved in the filling of these small ampules resulted in numerous cases of dermatitis and dizziness with two or three cases of fatal poisoning. In the use of these ampules by individual soldiers, no cases of poisoning have been reported.

One man sprayed his room with methyl bromide without any respiratory protection. He died 2½ days later. Other cases of poisoning during the use of methyl bromide as a disinfectant are reported.

• **INSIDIOUS.**—In the clinical picture, there are some interesting points. People inhaling methyl bromide do not receive any warning. The gas has no odor. The first symptoms appear very unimportant—such as slight irration of the mucous membranes or a feeling of heaviness in the head. For that reason, the person very often does not leave the room. Then, excepting in rare and very acute cases, there is a latent period of several hours up to two weeks before the normal and sometimes fatal symptoms develop.

Little is known of the toxic limit, but 20 ppm is at present tentatively considered by W. A. Cook to be the maximum allowable concentration.

SPECIFY MARLEY
Series 200
FOR AN
ENGINEERED SPRAY TOWER



If you need a cooling tower that

May be expanded at any time
Is pre-fabricated for easy erection
Can be erected by semi-skilled labor
Has complete Erection, Operation and Maintenance Instructions
Is assembled with heavy galvanized bolts
Is made of Heart Quality Redwood
Has double vertical columns
Is designed to withstand 100 mph wind
Has slip-fit louvers
Has complete basin with sump and automatic valve
Is designed with a balanced spray system
Has patented Marley Spray Nozzles
Will give long trouble-free service
Has Atmospheric Sections as optional equipment
Can be installed in an open location

YOUR BEST BUY is a MARLEY SERIES 200

Series 200 atmospheric spray towers are designed to meet the requirements of dairies, locker plants, air conditioning and thousands of other applications where low first cost is a "must."

By installing standard Atmospheric Sections in a Series 200 Cooling Tower various fluids may be cooled indirectly. Series 200 Coil Towers are especially desirable for Engine Jacket Cooling, Diesel Engine Cooling, Quench Oil Cooling, and for many other similar applications.

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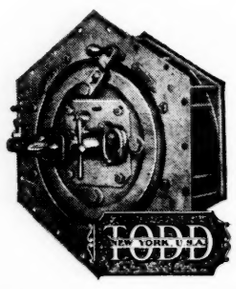

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NEW CATALOGS

Refrigeration Equipment

Two new refrigeration equipment catalogs present the B & G line. Catalog BJ-848 provides engineering data on the B & G Hydro-Flo Direct Expansion Evaporator. Selection data and diagrams of typical installations are included. Catalog BK-948 features finned tube condensers with selection data, capacities, and dimensions.—*Bell & Gossett Company, Morton Grove, Illinois.* 20

Electric Motor Selection

A discussion of the selection and maintenance of electric motors is contained in an illustrated booklet with examples, diagrams and rating curves.—*General Electric Co., Apparatus Department, Schenectady, N. Y.* 21

Unit Heater Trapping

A discussion of how to select steam traps for draining unit heaters by the Btu rating method and the condensate weight method is presented in an 8-page bulletin including charts, tables and data of the outputs of all sizes of unit heaters produced by 24 manufacturers. Recommended installation diagrams are also included.—*Armstrong Machine Works, Three Rivers, Mich.* 22

Evaporative Condensers

Kramer evaporative condensers are described in Bulletin R-162B, 6 pages, including diagrams, charts and tables of performance data, dimensions and correction factors.—*Kramer Trenton Company, Trenton 5, N. J.* 23

Evaporative Condensers

Freon-12 evaporative condensers, ECZ Series, are described and illustrated in an 8-page bulletin No. C-1100-B28. Specifications and capacity ratings are included.—*Worthington Pump and Machinery Corp., Air Conditioning and Refrigeration Division, Harrison, N. J.* 24

Sound Control

A 16-page brochure in two colors covers noise quieting acoustical correction and vibration isolation with photographs and detailed drawings of acoustical ceilings of several types.—*Johns-Manville, 22 E. 40th St., New York 16, N. Y.* 25

Packaged Gas Burner

Bulletin 7C describes Bryant Pow-R-Semblies, packaged industrial gas burner assemblies complete with pressure blowers. Capacities, specifications, dimensions, and alternative assemblies are presented. Size ranges from 400,000 to 6,600,000 Btu per hr output.—*Bryant Heater Co., Industrial Division, 1020 London Rd., Cleveland, Ohio.* 26

Thermocouples

Thermocouple and pyrometer accessories bulletin, No. P1238, 56 pages, includes a technical section with data on thermocouple life, corrosion and poisoning, insulation, and so on.—*The Bristol Co., Waterbury 91, Connecticut.* 27

Ceiling Panel System

Brad-Ray warming system, a method of installing ceiling panel radiation, uses twenty-foot loops of 5/16 in. copper tubing with patented headers. System is described in a 4-page bulletin.—*Jos. L. Bradfield, 10 N. Senate Ave., Indianapolis, Ind.* 28

Refrigeration Equipment

Catalog No. R-125 describes and illustrates Kramer refrigeration equipment including baffles, coils, condensers, heat exchangers, ice makers, thermobanks, unit coolers, panel units, and water coolers. Tables of performance data, dimensions and fittings with photographs and drawings of equipment are included. —*Kramer Trenton Co., Trenton, N. J.* 29

Turbo Pumps

Types CC and CG high speed single-stage turbo pumps are described in a 4-page bulletin. Pumps are for boiler feed duty, high pressure condensate, and other applications where high speed and high pressure are required.—*The J. S. Coffin, Jr., Company, 326 S. Dean St., Englewood, N. J.* 30

Electric Control Devices

A comprehensive tab-indexed catalog of electric control devices includes resistors, rheostats, relays, and accessories. Price sheets are bound in. Catalog is leather bound in loose-leaf style.—*Ward Leonard Electric Co., 31 South St., Mt. Vernon, N. Y.* 31

Refrigeration Valves

A 30-page catalog, No. 865, gives specifications on the full Baker line of valves, liquid gages, and other fittings for commercial and industrial air conditioning and refrigeration installations. Included are brief descriptions of compressors, condensing units, and auxiliary equipment.—*Baker Ice Machine Co., Inc., South Windham, Maine.* 32

Dehumidifier Data

Bulletin 214, 16 pages, presents a discussion of the performance of a solid adsorption dehumidifier by E. R. Queer and E. R. McLaughlin.—*Pittsburgh Lectrodryer Corp., Post Office Box 1766, Pittsburgh 30, Pennsylvania.* 33

Safety Relief Valves

Catalog 780, 24 pages, describes and illustrates Marine Industrial safety relief valves with tables of dimensions and specifications.—*Marine & Industrial Products Co., 1415 Vine St., Philadelphia 2, Pa.* 34

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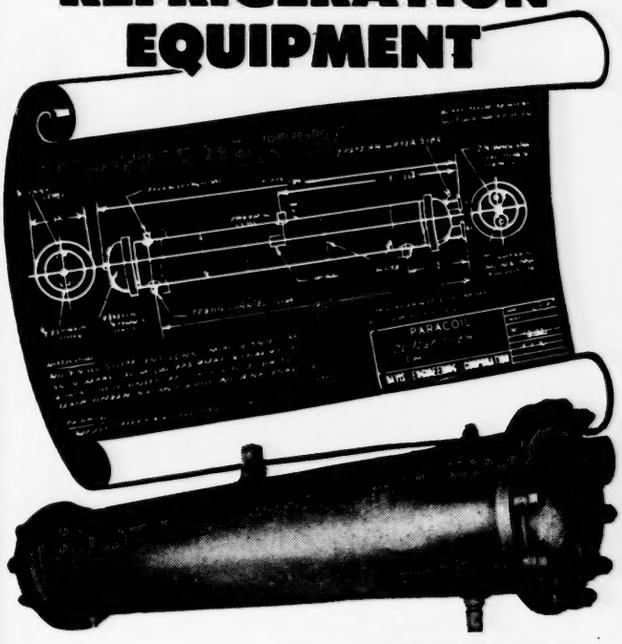

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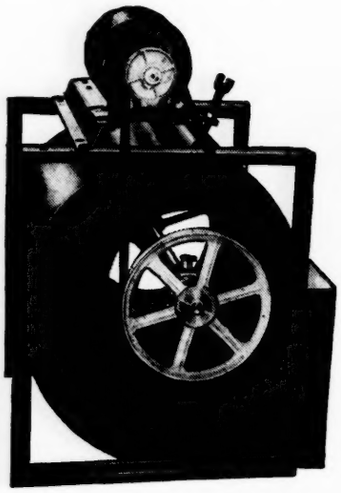

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Boiler Protective Surfacing

Bulletin 1530 describes Apexior Number 1, a protective surfacing material for boilers and for power and processing equipment. Application data and special equipment for internal coating of boiler tubes are included.—*The Dampney Company of America, Boston 36, Mass.* 35

Water Tube Boilers

Titusville 4-Drum water tube boilers are described and illustrated with drawings and tables of dimensions. Performance curves and special fueling arrangements are included.—*Titusville Iron Works, Titusville, Pa.* 36

Chemical Pump Seals

Worthington type EA mechanical seals for chemical pumps are described in Bulletin W-350-B10. Drawings, photographs, and exposed views illustrate applications and installation details.—*Worthington Pump and Machinery Corp., Harrison, N. J.* 37

Controls Service Handbook

A handbook for the heating control installer and service man applies to all oil, gas and stoker-fired heating systems, whether warm air, hot water or steam. The 72-page illustrated book contains many tips on quick and efficient servicing. Subjects covered include code identification, control circuits, thermostats, limit controls, oil, gas and stoker controls, trouble shooting, transformer specifications, thermostat heaters, plus a number of others.—*Minneapolis-Honeywell Regulator Co., 2753 Fourth Avenue, Minneapolis, Minn.* 38

Radiant Heating Controls Data

Technical Bulletin No. 1 is the first of a series designed to assist architects and engineers in selecting the appropriate controls for radiant heating systems. Includes descriptions and wiring diagrams of new thermostats recently developed especially for radiant heating.—*Sarcotherm Controls, Inc., 350 Fifth Ave., New York 1, N. Y.* 39

FEBRUARY, 1949

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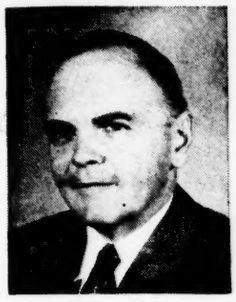
Getting Personal

Charles N. Witmer (co-author, *Problems in Air Conditioning Churches*, page 65) is general manager and treasurer of Ross & Witmer, Inc., Charlotte, N. C. He was born in Maryland. In 1930 he received a Bachelor of Science degree from Georgia School of Technology. Following graduation he was employed by the Carrier Corp., Newark, N. J. He spent 15 years with that corporation in various capacities. During the last 10 years with them he was dealer manager in Dallas, Tex., and Atlanta, Ga. In 1945 he established Ross & Witmer, Inc., in Charlotte, N. C., handling Carrier products for the southern half of the state.



M. F. Wooten, Jr.

C. N. Witmer

M. Frank Wooten, Jr. (co-author of *Problems in Air Conditioning Churches*, page 65) is a consulting engineer associated with Wooten & Wooten, consulting engineers and architects, Charlotte, N. C. He was born in Charlotte, received his B.S. in Engineering at the University of North Carolina, did graduate work in Europe with the Rutgers University Extension Division and later at the University of North Carolina.

Mr. Wooten's first air conditioning work was with Frigidaire, operating out of the Roanoke, Va., distributor's office. Since entering professional practice, his experience has covered a large variety of types of air conditioning projects, including commercial and industrial fields.

. . . Since the Last Issue

H. F. Smiddy

Harold F. Smiddy has been elected a vice president of the **General Electric Co.** Mr. Smiddy continues as general manager of both the company's air conditioning and chemical departments. A former partner in the firm of Booz, Allen, and Hamilton, industrial management consultants, Mr. Smiddy joined General Electric last March as a member of the president's staff. He was appointed general manager of the chemical department at Pittsfield, Mass., in July and three months later was given additional duties as general manager of the air conditioning department, Bloomfield, N. J.

White-Rodgers Electric Co. has recently established a nation-wide system of exchange agencies, authorized to furnish repair and replacement service on White-Rodgers controls. These agencies will also serve as a source of information on controls and control systems. The agencies also will stock certain control parts and sub-assemblies required by servicemen in their service work.

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Processing of Sodium
Vitamin Mfgr.
Gunpowder Processing
Processing Plastics
Rocket Powder Processing

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General • Ceramics Drying
Storage of Highly Finished Metal Parts (Corrosion Prevention)
Compressed Air Drying
Covered Cable Drying

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Powdered Metals Processing
Cupola Dry Blast (Foundry)
Safety Glass Manufacturing
Magnesium Castings Production
Aluminumizing Process

FOOD
Drying of Icings—Bakery
Candy Making • Fish Drying
Bean Sprout Cultivation
Vegetable Dehydration
Processing Powdered Coffee
Cranberry Dehydration
Milk Drying • Spaghetti Mfgr.

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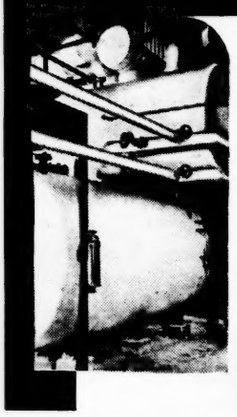

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Directors of **McQuay, Inc.**, Minneapolis, manufacturers of heating, air conditioning and refrigeration equipment, have elected **Philip S. Morris** executive vice president and **H. Blake Thomas** vice president in charge of sales. Mr. Morris joined the company two years ago as assistant to the president and a year ago was advanced to vice president in charge of advertising, purchasing and credit. Before his association with McQuay he was executive vice president of McQuay Aircraft Corp. and Plxweve Manufacturing Corp., both of Los Angeles. Mr. Thomas served successively as assistant sales manager and general sales manager before his election as a vice president. He joined the company January 1, 1947 after returning from England where he was general sales manager of Chronomatic Corp., manufacturers of time control equipment, during the war.

C. T. Perkins

Charles T. Perkins has been elected president of the **Modine Manufacturing Co.**, Racine, Wisconsin, to succeed W. C. Winkel, who died on August 22 of last year. The new president joined the Modine organization in 1917 to become sales manager and later, chief engineer. Since 1934 he has been vice president in charge of engineering. Arthur F. Thompson, previously vice president, was elected executive vice president. **Arthur G. Dixon**, secretary of the company since 1943, was elected vice president and secretary. Other officers re-elected are G. H. Jackson, vice president in charge of purchasing, Robert Grant, vice president in charge of manufacturing, and E. G. Rutherford, treasurer. A. B. Modine, founder of the company, will continue to serve as chairman of the board.

Fasco Industries, Inc., is the new name for **F. A. Smith Manufacturing Co., Inc.**, long-established manufacturer of fans, motors, ventilators, blowers and automotive electrical equipment. The new name conforms with the trademark used on the company's products. There is no change in corporate structure, officers, directors, or policies.

Home offices of the **Pittsburgh Corning Corp.** are being transferred from the Pittsburgh Plate Glass Building to new larger offices located at 307 Fourth Ave., Pittsburgh.

Appointment of **William G. Loye** as sales representative of the heating and refrigeration divisions of the **Fedders-Quigan Corp.** is announced. Mr. Loye's headquarters are in South Bend, and he will cover the northern counties in Indiana.

Perfection Stove Co. has announced the appointment of **L. Bushfield** as sales manager of the company's range and heater division. For the past four years manager of Perfection's Atlanta, Ga., district, Mr. Bushfield succeeds O. H. Larimer, who is retiring after 30 years as a member of the company's sales division. **C. C. West** will replace Mr. Bushfield as manager of the Atlanta district.

C. A. Scharschu, director of research of **Allegheny Ludlum Steel Corp.**, has been appointed assistant technical director. **Dr. L. C. Hicks**, associate director of research, will fill Mr. Scharschu's former position.

The Pyle-National Co. of Chicago has appointed the **Heating Equipment Co.**, 12 Third Street, N.E., Atlanta, Ga., as manufacturer's representatives for its industrial multivent panels in Tennessee, Alabama and Georgia.

Acme Industries, Inc., has announced the appointment of **Alwin B. Newton** as director of sales. Mr. Newton was with Chrysler Airtemp, Dayton, Ohio, as chief engineer and chief development engineer for five years. Previously he served eight years with Minneapolis-Honeywell as manager of the refrigeration division. He has also been associated with York Corporation and General Electric.

The Coroaire Heater Corp. has announced the promotion of **T. G. Leonard** to the position of assistant sales manager. Mr. Leonard has been associated with Coroaire Heater Corp. since his release from the A.A.F. three years ago, in the sales and advertising department. He is a graduate of University School of Cleveland, Ohio; Brown University of Providence, Rhode Island; and Babson Institute of Business Administration, Babson Park, Mass.

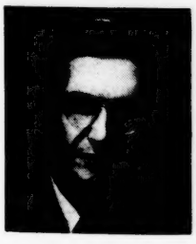
The appointment of **Edward V. Sullivan** as advertising and sales promotion manager of **The Lau Blower Co.**, Dayton, Ohio, has been announced. Mr. Sullivan was formerly an account executive with the Hutzler Advertising Agency and prior to that was assistant to the advertising manager of The Sheffield Corp. He served four years in the AAF, seeing action in North Africa, Italy and the Mediterranean area.

Automatic Switch Co., Orange, N. J., manufacturers of electromagnetic controls, announces the appointment of **F. P. Spinelli** as manager of the switch department and **R. F. McCormick** as manager of solenoid valve sales. Both Mr. Spinelli and Mr. McCormick have been with the company for many years.

Binks Manufacturing Co. announces the election of **Joseph D. Linehan** to fill a vacancy on the board of directors of the corporation. Mr. Linehan is president of the Continental Plastic Corp., 308 W. Erie St., Chicago. He is also a vice president of Linehan, Inc., printers and lithographers, and a director of the Liberty Federal Savings and Loan Association of Chicago.

Baker Ice Machine Co., Inc., of South Windham, Maine, and Omaha, Nebraska, announces the appointment of **H. H. Paltridge** as special sales representative in New York City. He will be located at the company's offices at 103 Park Ave.

Frank S. G. Williams of New York, eastern manager of **Taylor Forge and Pipe Works**, has been designated chairman of ASA Sectional Committee B-31, which is responsible for the American Standard Code for Pressure Piping.



E. S. McKay

E. S. McKay of Schenectady, New York, has been named advertising and sales promotion manager of the **General Electric Co.'s Air Conditioning Department**, with headquarters at Bloomfield, N. J. Mr. McKay had been assistant to the manager of employee and community relations in the G. E. Apparatus Department. A native of Platte, South Dakota, he came to General Electric in 1933, following his graduation from the University of Michigan. Two years later he became district publicity representative in Chicago. He left the company for two years and returned in 1938 as a supervising editor in the Publicity Department at Schenectady. In December 1945 he was named manager of the district and distribution division of the advertising and sales promotion division, G. E. Apparatus Department, at Schenectady. In November 1947 he was named to the post he held before his present appointment.

Peerless Pump Division, Food Machinery and Chemical Corp., announces the appointment of **J. W. L. Stone** as district manager of a newly formed Peerless sales district with headquarters located at 4330 Leavenworth Street, Omaha, Nebraska. Mr. Stone was formerly a field engineer for the Peerless division in the southwest district. As district manager, he will now supervise the sales of both the Peerless horizontal and vertical lines and other pumps of the company's manufacture. His territory will include North and South Dakota, Montana, Minnesota, Nebraska, Kansas, Colorado and portions of Wyoming, Missouri, Wisconsin and Iowa.

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HEATING AND
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All copper spiral fin tube construction with the tubes formed or bent permits uniform expansion without strain. Headers are heavy wall construction with tubes brazed into extended ferrules formed in the headers. Fins are helically wound and metallically bonded. May we send catalog?

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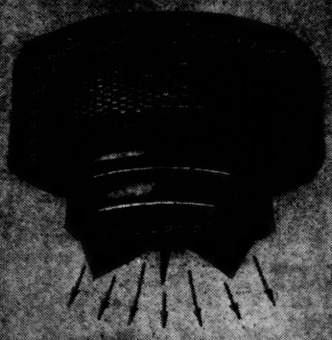

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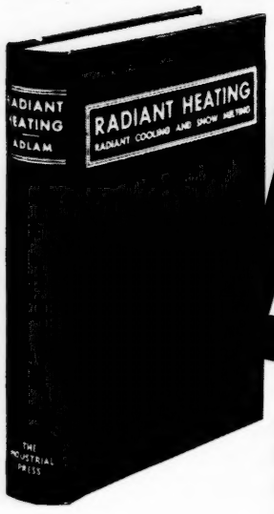

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THE INDUSTRIAL PRESS

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The appointment of **Bert E. Dinsmore**, long-time appliance merchandising executive, to the newly created post of sales manager of **The Guiberson Corp.**, oil heater division, has been announced by Al Pranger, general sales manager of the Dallas, Texas, concern.

Yarnall-Waring Co., Philadelphia, announces the following changes in its sales and manufacturing divisions: **Joseph Kildare**, sales manager has been elected vice president in charge of sales and **Frank W. Miller**, works manager, has been elected vice president in charge of manufacturing. **Carl Liberg**, formerly associated with the company's New York sales office, is now located at the new district office in Buffalo, and **C. V. Peterson** has been appointed sales representative in the Cleveland district.

David M. Ramsey has been appointed manager, heating products, **Jones & Brown, Inc.**, Pittsburgh. Mr. Ramsey has resigned as district sales manager, southeastern territory, for the Richmond Radiator Co., Washington, D. C. He will be responsible for sales and distribution for the full line of the company's Ko-Z-Aire conditioning units and RAC controls. Mr. Ramsey comes to Jones & Brown after wide experience in heating and sales. He was formerly manager of the industrial division and assistant manager of heating sales for the National Radiator Company. He was previously associated with both Westinghouse and General Electric in refrigeration and air conditioning.

As of January 1, 1949, **Reliance Regulator Corp.** was taken over by its parent company, **American Meter Co., Inc.**, and became **Reliance Regulator Division of American Meter Co., Inc.**

The appointment of **R. A. Bissell** as assistant sales promotion manager of the **Bryant Heater Co.** has been announced. Mr. Bissell, formerly connected with the Brooklyn Union Gas Company and later serving as a sales representative in the Bryant New York Office, will move to the Cleveland, Ohio, headquarters of the Bryant Heater Co.

Edward R. Legg, president of the Refrigeration Corporation of America, Newark, New Jersey, has been elected to the board of directors of the **Air Conditioning and Refrigerating Machinery Association, Inc.** Mr. Legg is also chairman of the Ice Cream Cabinet Section of ACRMA.

E. M. Ford has been named district manager of the Los Angles, Calif., territory for **Penn Electric Switch Co.** Mr. Ford, formerly assistant advertising manager of the company, has been with Penn for 18 years.

Oliver H. Schaaf, formerly vice president and general manager of the **Air-Maze Corp.**, has been elected president and will continue as general manager, according to a recent announcement by the company. A. E. Schaaf, president for nearly 25 years, has been elevated to chairman of the board of directors.

INDUSTRIAL DEGREE-DAYS
December, 1948

City	55F Base	45F Base
Baltimore, Md.	444	187
Buffalo, N. Y.	702	395
Chicago, Ill.	694	390
Cleveland, Ohio	660	353
Detroit, Mich.	722	414
Indianapolis, Ind.	641	353
New York, N. Y.	506	240
Philadelphia, Pa.	490	225
Pittsburgh, Pa.	549	270
St. Louis, Mo.	516	260

Canadian Degree-Days for December, 1948*

City	December 1948	December Normal	Cumulative, Sept. 1 to Dec. 31 1948	Cumulative, Sept. 1 to Dec. 31 Normal
Calgary, Alta.	1702	1426	3710	3702
Charlottetown, P.E.I.	1104	1246	2611	2865
Crescent Valley, B. C.	1407	1240	3419	3279
Edmonton, Alta.	1832	1578	4087	3984
Fort William, Ont.	1541	1596	3488	3815
Grande Prairie, Alta.	2027	1649	4480	4159
Halifax, N. S.	1011	1138	2321	2615
London, Ont.	1128	1200	2506	2677
Medicine Hat, Alta.	1723	1417	3447	3389
Moncton, N. B.	1237	1373	2890	3186
Montreal, P. Q.	1184	1407	2563	3096
North Bay, Ont.	1404	1528	3133	3503
Ottawa, Ont.	1243	1494	2699	3277
Penticton, B. C.	1243	1073	2922	2626
Porquis Junction, Ont.	1497	1786	3452	4248
Prince George, B. C.	1742	1504	4053	3757
Quebec City, P. Q.	1274	1534	2805	3511
Regina, Sask.	1953	1779	4132	4336
St. John, N. B.	1110	1271	2585	2969
Saskatoon, Sask.	1996	1767	4185	4249
Toronto, Ont.	1028	1155	2204	2644
Vancouver, B. C.	958	818	2441	2168
Victoria, B. C.	840	738	2133	1910
Windsor, Ont.	1042	1172	2208	2446
Winnipeg, Man.	1826	1829	3694	4205

*These data are supplied through the courtesy of the Meteorological Division, Air Service Branch, Department of Transport, Canada.

COMING EVENTS

MARCH 9-27—Annual Fuel Engineering Conference, Horace H. Rackham Educational Memorial Building, Detroit, Mich. Meeting sponsored by Appalachian Coals, Inc., Cincinnati, Ohio.

APRIL 18-20—1949 Midwest Power Conference, sponsored by Illinois Institute of Technology, at Hotel Sherman, Chicago. Conference director, Roland A. Budenho'zer, at Illinois Tech, 3300 S. Federal St., Chicago 16, Ill.

APRIL 21-23—22nd annual convention, The New York State Society of Professional Engineers, Inc., Hotel New Yorker, New York. E. J. Quirin, vice president, Frederic R. Harris, Inc., 27 William St., New York 5, N. Y.

MAY 12-13 — Fourth annual spring meeting, Instrument Society of America, Royal York Hotel, Toronto, Ont., Canada. Instrument Society of America, 1117 Wolfendale St., Pittsburgh 12, Pa.

MAY 16-20—National Oil Heat Exposition, Mechanics Hall, Boston, Mass. Sponsored by Oil-Heat Institute of America, Inc., 6 E. 39th St., New York 16, N. Y.

MAY 24-27—Annual meeting, National District Heating Association, The New Ocean House, Swampscott, Mass. Secretary, John F. Collins, Jr., 827 N. Euclid Ave., Pittsburgh 6, Pa.

JUNE 5-8—Spring convention, American Society of Refrigerating Engineers, on the Steamer Richelieu, which will sail from Montreal, Canada. Secretary, M. C. Turpin, 40 W. 40th St., New York, N. Y.

SEPTEMBER 12-16—Convention of the Instrument Society of America, Municipal Auditorium, St. Louis, Mo. Instrument Society of America, 1117 Wolfendale St., Pittsburgh 12, Pa.

NOVEMBER 14-19 — All-Industry Refrigeration and Air Conditioning Exposition, Atlantic City, N. J. Refrigeration Equipment Manufacturers Association, 1107 Clark Bldg., Pittsburgh 22, Pa.

DECEMBER 4-7—46th annual convention, American Society of Refrigerating Engineers, Edgewater Beach Hotel, Chicago, Ill. Secretary, M. C. Turpin, 40 W. 40th St., New York, N. Y.

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GALVANIZED STEEL FRAMES

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Available in standard 1" and 2" thickness, or for industrial and special applications in 2" to 4" thickness. Holding frames for all type filters for V type or straight banks.

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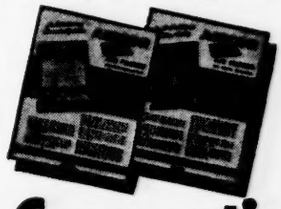

Air Filter Corporation

108-H North Water St., Milwaukee 2, Wis.

Canadian Representative

DOUGLAS ENGINEERING CO., LTD. MONTREAL